INJURY BULLETIN

Queensland Injury Surveillance Unit

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Occupational Eye Injuries

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QISU collects and analyses data from emergency department injury presentations on behalf of Queensland Health. Participating hospitals represent three distinct areas of Queensland.

QISU publications and data are available on request for research, prevention and education activities.

HOSPITALS:
Mater Children's, Mater Adult, Princess Alexandra, Redland, Logan, Royal Children's, Mount Isa , Mackay Base, Mackay Mater, Proserpine, Sarina, Clermont, Dysart, Moranbah and Mareeba.

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Summary

- Eye injuries occur frequently in the work place (at least 4700/year in Queensland).
- Occupational eye injuries represent 21% of all occupational injuries.
- Workers in construction, manufacturing and mining are particularly at risk.
- 38% of all occupational injuries in manufacturing are eye injuries.
- Most occupational eye injuries are foreign bodies in the eye (71%).
- Almost one third of occupational eye injuries occurred whilst using a grinder.
- Occupational eye injuries can be prevented by environmental control measures, correct selection of tools and personal eye protection.
- Fitted goggles with or without a face shield are required for grinding, drilling and cutting. Safety glasses do not provide adequate protection while performing these tasks.

Introduction

Occupational eye injury is a common cause of workers compensation claims in Queensland, with over 4000 claims registered a year[1]. Occupational eye injury also occurs frequently throughout Australia (estimated at 1.7 to 6.9 injuries/1000 workers/year) [2, 3] and internationally (estimated at 5.37/1000 workers/year in the USA.)[4].

Information from previous Australian studies shows that the use of safety glasses does not provide adequate protection from all potential eye injury in the work place[5, 6].

Previously QISU has described the dangers of using grinders in both the workplace and the home, the most prevalent injury associated with the grinder being particles impacting the eye[7, 8].

This issue of the bulletin describes occupational eye injury in Queensland.

Methods

QISU collects data from Queensland hospital Emergency Departments that cover 25% of the population with approximately 80% ascertainment. Results in this report then represent about 20% of the Queensland injury burden.

Data for this bulletin was gathered by searching QISU database for occupational eye injuries, for the seven year period, from January 1st 1998 to December 31st 2004.

Results

Between 1998 and the end of 2004 there were 6625 people with work related eye injuries who presented to a QISU participating Emergency Department for treatment. This represents 21% of all occupational injuries and 47% of all eye injuries during the study period.

Age and Gender

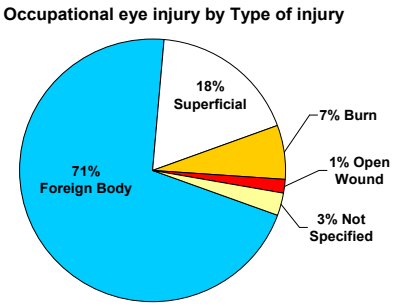
Most injuries occurred in the 20 to 40 year age group (66%). Injuries were relatively uniform across this age range (11% - 18%). Only one occupational eye injury was recorded in the less than 15 year age group.

Men were far more likely to be injured than women (96%). Injuries to females were of a different pattern and are described in more detail below.

Nature of Injury

The majority of eye injuries (71%) were a foreign body in the eye. Eighteen percent of injuries were superficial including contusions, corneal abrasions and lacerations to the external eye.

Burns to the eye represented 7% of injuries; these were approximately 50% welder's flash burns and 50% burns from chemicals and other material.
There were 11 cases of penetrating eye injury, the most serious injury seen in this study.



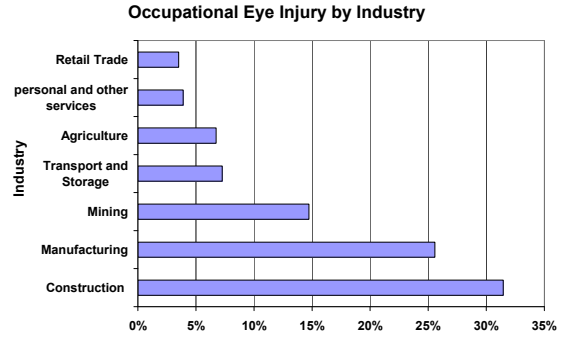
Severity

Forty-one percent of patients had a triage category of urgent or above (requiring treatment in less than 30 minutes) on presentation to the Emergency Department. There were no patients who were classified as category 1 (requiring resuscitation).
Eighty-six patients (1.6%) required acute admission for further treatment.

Cause of Injury

The most common item associated with occupational eye injury was the angle grinder (31%), the welder (17%), pieces of metal (11%), and various chemicals (6.5%).
Angle grinder injuries were almost all foreign body in the eye (97%). Injuries associated with the welder were foreign body (43%), superficial injury (35%) and flash burns (22%).

Industry



The construction industry accounted for 32% of all Emergency Department presentations with occupational eye injuries. This was followed by manufacturing (25%) and mining (15%) (note that QISU participating Emergency Departments include Mt Isa, Dysart and Moranbah where mining is prevalent).
These injuries represent 15% of all occupational injuries in construction, 38% of all occupational injuries in manufacturing and 22% of all occupational injuries in mining.

Eye Protection

Information about personal eye protection (PEP) is not specifically sought in the database but 1167 (18%) of those injured specifically indicated that they were wearing some form of eye protection at the time of their injury.

Further Analysis by Injury Type

Foreign Body Injuries

4689 patients sustained a foreign body in their eye. The mean age for those injured in this manner was 33 years and 97% were males. Forty one percent had a triage category of urgent or above.
The most important factor described by workers was the use of power tools, 45% of foreign body injuries occurred while grinding, 12% whilst using other power tools. Workers with these injuries were most commonly in the construction industry (33%) and the manufacturing industry (26%).

Burns

There were 454 people who presented to an emergency department with burns to their eyes. Fifty-six percent of these were flash burns.

Flash Burns

Flash burns occurred to 251 individuals, this represents 3.8% of all occupational eye injuries. Only one female was injured in this manner. The average age of those injured was 31 years. Sixty-two percent of these patients had a triage category of urgent or above, with only one patient requiring admission. Eighty percent of these could be regarded as 'professional' welders (occupational groups "welder", "fitter and turner" and "boilermaker"), with the others being in occupations not primarily associated with welding or were 'passers-by' (injured whilst in the vicinity of the welder).

Chemical Burns

Chemical Burns occurred to 206 individuals, representing 3% of all occupational eye injuries. These injuries occurred to workers in a much wider variety of occupations and included 25% females. The average age of these patients was 32 years. Eighty percent of these patients had a triage category of urgent or above, and 8% of these patients were admitted, suggesting these were more serious injuries. 'Services to mining' was the most common industry (10.7%) followed by food retailing (10.2%) and then health services (7.3%). The most common product associated with chemical eye burns was bleach (16%), acid (11%) and soap/detergent (11%).

Penetrating Eye Injuries

Of the 11 penetrating eye injuries identified, 10 occurred to men. Seven of these patients were admitted for further care. Most penetrating injuries occurred during manufacturing or construction whilst using power tools or nail guns.

Gender Related Differences

Females (264) were less likely than males to present to an ED for treatment of an eye related occupational injury (4%). The mean age was 33 years for females and 32 years for males.
Injuries to females most commonly occurred in the food retailing (13%) and accommodation (10%) industries, compared with construction (32%) and manufacturing (25%) for men.
Injuries to females were most likely to be caused by a chemical, included soap or detergent (13%) bleach (11%) and other chemical (10%). In males the angle grinder (32%), welding equipment (17%) and piece of

metal (10%) were the 3 most likely objects associated with occupational eye injury.
Fifty-seven percent of females and 44% of males had a triage category of urgent or above, with 2.3% of females and 1.5% of males requiring admission for further management of their injuries.

Discussion

We estimate that there are approximately 4700 ED presentations per year in Queensland with occupational eye injuries, a rate of injury of 3.1/1000 workers/year (using workforce estimates from the Office of Economic and Statistical Research) [1].
By comparison, there are approximately 4200 claims for workers compensation for eye injuries in Queensland per year (2.8/1000 workers/year) [1].
The total number of occupational eye injuries is almost certainly higher than both of these estimates as workers compensation data is known to underestimate injury incidence and it is likely that some eye injuries were managed on site or at other health facilities[4,9].
Other studies estimate rates of occupational eye injuries as 6.90/1000 workers/year (Australia - 1989-1991) [2] and 5.37/1000 (USA - 1997-1998) [4].
Each occupational eye injury results in approximately 1.8 working days lost[1]. We estimate that at least 8500 working days are lost each year in Queensland from occupational eye injuries.
Penetrating eye injuries are potentially vision threatening (usually monocular), and can result in significant morbidity. Non-penetrating eye injuries are often very painful and distressing (41% of these injuries were triaged as urgent or above).
Occupations involved in working with metal are most at risk for eye injuries. Workers in construction, manufacturing and mining accounted for 72% of all occupational eye injuries.
The highest risk activity was grinding, involved in 31% of all injuries. Grinding is known to be a very high risk activity[3,4] as it produces a spray of medium velocity particles which impact the user or bystander from many directions. Eye protection that provides only frontal or frontal and side protection is unable to prevent foreign body impact. Grinders may also cause other serious injuries including kickback injuries causing deep lacerations and tissue loss[7,8].
Similar activities like hammering metal, drilling, scaling and cutting are also known to produce medium velocity particles and can result in foreign body impact from many directions.
Welding resulted in 17% of all injuries. The foreign body and superficial eye injuries sustained while welding occur before or after the weld is made, when appropriate PEP is not used for tasks such as grinding. Flash burns can occur as the welder strikes the arc before applying PEP, while carrying out a 'small job' while not using PEP, or to bystanders who are inadequately protected.
Data on "Bystander" or "passer by" injury is not specifically collected by QISU. The literature suggests that this is quite a common problem (5 to 10% of total injuries) which is usually caused by poor workplace design and inappropriate selection of eyewear[3, 10, 11].
At least 18% of workers had commented that they were wearing some form of PEP at the time of their injury. As failure of the integrity of the eyewear itself is rare[2], these injuries probably occurred when workers used poorly fitting eye wear or eye wear that was inappropriate for the task[5, 6, 12].

Prevention

A number of relatively recent publications describe methods to prevent occupational eye injuries[13, 14, 15, 16, 17].
Risk assessment is the first component, followed by the three step approach to prevention as recommended in Australian Standard 1336-1997 [18].

* Eliminate possible eye hazards
* Control potential hazards
* Use correct PEP

Risk Assessment

Employers need to assess the risk of injury to their employee's eyes so that preventative actions can be taken. Employers have a duty of care to provide a safe working environment[19].
Foreign bodies, radiation (mainly flash burns) and chemicals should be identified in individual work environments and preventive strategies developed for local conditions. Therefore any tasks (even if infrequent) that involve potential exposure to these risks need to be part of a prevention program.

The Elimination of Possible Eye Hazards

* Aim to use machinery or methods that generate less potential eye damaging material.
* Dust suppression – wetting areas, reduction in wind Mechanical handling/automation

The Control of Potential Hazards

* Isolate the hazard by clear identification of high risk areas, defining and marking safe working distances, use of safety barriers or screens (for example safety curtains around fixed welding areas).
* Adequate ventilation
* Adequate lighting – thus improving compliance with the use of PEP, maximising the distance from hazard to eye and keeping the pupil as small as possible (reducing radiation entry) [16].

Correct PEP

Supply of PEP

Standards for eye protection are described in;
AS/NZS 1336 (1997) – providing recommended practices for protecting eyes against common industrial hazards[18].
AS/NZS 1337 (1992) – providing recommendations for minimum requirements for manufacture/design of eye protectors[20].
Grinding, drilling, scaling, machine disc cutting are regarded as medium impact hazards in AS 1336, which endorses wide vision spectacles for these activities. However it is clear that spectacles with side shields are inferior to goggles with or without a face shield in the prevention of FB injuries when performing these activities[6, 21, 22].
Hammering is classified as a low impact hazard in AS 1336, but hammering is strongly associated with penetrating eye injury[2]. Hammering should be regarded as a medium impact hazard requiring all round protection from medium impact ie goggles.
For welding, welding helmets fitted with auto darkening lenses should be used as they are likely to provide significant advantages in safety. These helmets have lenses that darken and lighten very rapidly depending on the amount of light detected, this provides good vision while preparing to start welding, turns dark immediately on starting welding, and does not need to be removed to

perform other tasks that are potentially dangerous to the eye eg grinding.
Goggles or a face shield should be used in all situations were exposure to a dangerous chemical is possible.

Fitting of PEP

AS 1336 1997 4.3b states "that, wherever practicable, eye protectors are fitted to the wearer by a person who is competent to select the correct size and type" [18].
Well fitted PEP will improve employee compliance and prevent foreign body injury more effectively. Were possible the issue for exclusive use by one employee is recommended.

Maintenance

Once the appropriate workplace changes have been made and eye protection has been selected and fitted, a maintenance program is required. Without such a program it is likely that injuries will continue to occur[11].
This program should include; Ongoing staff education, maintenance of PEP (cleaning and replacement of damaged equipment) and regular eye checks.

First Aid

Immediate first aid is an important step in reducing the severity of chemical eye injury as they require immediate irrigation with large volumes of clean water. Employers need to provide facilities for irrigation and employees need to be trained how to perform eye irrigation. After on site irrigation, urgent medical review should be sought to allow local anaesthetic application and further irrigation.

Recommendations

- Employers and employees should recognise the importance of workplace eye safety. Workplaces require an overall eye injury prevention program with a maintenance component
- Greater attention should be paid to reducing bystander injury
- Personal eye protection should be individualised, expertly fitted for workers in high risk industries
- Where possible an alternative to grinder use should be sought and grinding should only be performed by trained workers using goggles and a face shield.
- Goggles +/- face shield should be used for activities like grinding, drilling, scaling and cutting
- Hammering should be regarded as medium impact activity, thus requiring safety goggles +/- face shield
- Australian Standard 1336 should be altered to recognise that glasses with side shields do not provide adequate protection for activities like grinding, and hammering should be classified as a medium impact activity.
- Welding helmets with auto darkening lenses should be used where possible

Acknowledgments

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Resources/Links

- Optometrists Association Australia. Workplace eye safety fact sheet 2005. http://www.optometrists.asn.au/eyevision/eyeprotection/workfactsheet
- WorkSafe Western Australia – Eye injuries. http://www.safetyline.wa.gov.au
- Safety, Rehabilitation and Compensation Commission (Comcare)
- Guidance on the Management of Eye Health in the Workplace 16/11/05 http://www.comcare.gov.au/publications/eyehealth/index.html

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17. Safety, Rehabilitation and Compensation Commission (Comcare) Guidance on the Management of Eye Health in the Workplace 16/11/05 http://www.comcare.gov.au/publications/eyehealth/index.html
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