

# Evaluation of occupational ocular trauma: are we doing enough to promote eye safety in the workplace?

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## ABSTRACT • RÉSUMÉ

**Objective:** The aim of this study was to document the use of eye personal protective equipment (PPE) by patients who had sustained an eye injury in the workplace and to evaluate the characteristics and outcomes of these patients.

**Design:** Case-control study.

**Participants:** All adult patients who had sustained an eye injury in the workplace and presented to the urgent ophthalmology clinic of a tertiary care hospital from October 1, 2013, to November 30, 2014, were eligible for inclusion.

**Methods:** Medical records were reviewed to obtain occupational eye injury data, including etiology, type, and severity of injury as per the Ocular Trauma Score. Use of eye PPE at the time of injury was recorded. Outcome data, including disposition, duration of follow-up, and return to baseline best-corrected visual acuity, were also recorded.

**Results:** One hundred sixty-nine patients were included in this study. The median age of the cohort was 31 years (range, 17–68 years), and 92.9% were male. Chemical exposure (31.4%), grinding (17.9%), and injuries sustained by a sharp-object, metal, or nail (13.1%) were overall the most common etiologies of injury. Eye PPE was not worn by 66.9% of the cohort, with 33.1% of the cohort sustaining an occupational eye injury despite the use of eye PPE.

**Conclusions:** Use of eye PPE among workers who sustain an eye injury in the workplace remains low; yet, its use does not preclude a significant proportion of such workers from injury. Increasingly advocating for both the use and appropriate selection of eye PPE in the workplace is an important public health initiative that should therefore be encouraged.

**Objetif :** Documenter l'utilisation d'équipement de protection individuelle (EPI) pour les yeux chez des patients qui ont subi une blessure à l'œil en milieu de travail, et évaluer les caractéristiques et le devenir de ces patients.

**Nature :** Étude cas-témoins.

**Participants :** Tout adulte ayant subi une blessure à l'œil au travail et s'étant présenté à la clinique d'urgence ophtalmologique d'un hôpital de soins tertiaires entre le 1<sup>er</sup> octobre 2013 et le 30 novembre 2014 étaient admissibles à cette étude.

**Méthodes :** On a consulté le dossier de chaque patient afin de recueillir des données sur sa blessure – cause, type et gravité selon le score OTS (Ocular Trauma Score) – et de vérifier si le patient portait de l'EPI au moment de la blessure. On a également consigné diverses données sur les résultats, dont le devenir des patients, la durée du suivi et le retour à la meilleure acuité visuelle corrigée (MAVC) initiale.

**Résultats :** L'étude regroupait 169 patients, dont 92,9 % d'hommes. L'âge médian de la cohorte était de 31 ans (de 17 à 68 ans). La plupart des blessures avaient été causées par l'exposition à des substances chimiques (31,4 %), le meulage (17,9 %) et le contact avec un objet tranchant, une pièce de métal ou un clou (13,1 %). Dans cette cohorte, 66,9 % des sujets ne portaient pas d'EPI au moment de la blessure, et 33,1 % des sujets se sont blessés en dépit du port d'EPI.

**Conclusions :** Le port d'EPI chez les travailleurs ayant subi une blessure à l'œil demeure faible, et de nombreuses blessures sont survenues malgré celui-ci. Ainsi, la promotion accrue de l'utilisation et de la sélection appropriée d'EPI pour les yeux est une initiative de santé publique importante.

Ocular trauma remains a significant global cause of visual morbidity.<sup>1–3</sup> It is estimated that 1.6 million people are blinded as a result of eye injuries worldwide.<sup>4</sup> Moreover, population-based data suggest that up to one-third of monocular blindness may result from eye injuries, representing an additional 19 million people negatively affected by ocular trauma.<sup>4,5</sup> Although these figures may vary depending on regional differences, ocular trauma as a cause of visual morbidity is undoubtedly a notable area of concern.

A significant proportion of ocular trauma occurs in the workplace, with one prospective study of 5671 eye injuries revealing that this value can be as high as 69.9%.<sup>6</sup> According to the Centers for Disease Control

and Prevention, approximately 2000 workers in the United States experience an occupational eye injury each day; one-third of these injuries are treated in hospital emergency rooms, and over 5% result in loss of time at work.<sup>7</sup> In Canada, the problem is likewise significant. Each day, approximately 700 Canadians sustain an eye injury in the workplace.<sup>8</sup>

Several studies have demonstrated the significance of ocular trauma in various occupations. Occupational eye injuries were most common in welding-related occupations and accounted for 25% of all Workers' Compensation Board (WCB) claims in the United States.<sup>9</sup> Occupational eye injuries in the workplace were the third most common among unionized carpenters.<sup>10</sup>

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Furthermore, Wong et al. reported an incidence rate of 14.9 per 1000 person-years in a major United States automobile corporation.<sup>11</sup> Evidence suggests that within the United States, workers with less than a high school education, non-Hispanic whites, the self-employed, and those in the midwest region were more likely to experience an eye injury in the workplace.<sup>12,13</sup> Nonetheless, limited research on the epidemiology of ocular trauma has been undertaken in Canada.

As such, the purpose of our study was threefold: (i) to describe the etiology, type, and severity of occupational eye injuries sustained by adult patients presenting to the urgent ophthalmology clinic of a tertiary care hospital of a large Canadian city; (ii) to document the use of eye personal protective equipment (PPE); and (iii) to evaluate the characteristics and outcomes of these patients.

## METHODS

### Patient population and research setting

All adult patients presenting to the urgent ophthalmology clinic of a tertiary care hospital located in Calgary, Alberta, Canada, from October 1, 2013, to November 30, 2014, were eligible for inclusion in the study. Patients who sustained an occupational eye injury were identified and included in this study. Occupational eye injuries were defined as any injury occurring to the eye(s) and/or adnexa(s) that occurred in the patient's regular place of work during working hours. The determination of whether the eye injury occurred in the workplace was made by review of ophthalmologists' and ophthalmic technicians' notes and/or whether documentation was filed to the provincial WCB. As the incidence of eye injuries in patients presenting with major polytrauma has been previously reported as very low, these patients were excluded from the study.<sup>14</sup>

Approval from the appropriate institutional research ethics board was obtained prior to commencement of this study.

### Study process and parameters

The medical records of eligible patients identified as having sustained an occupational eye injury were retrospectively reviewed to obtain the study parameters of interest. Demographic data collected included patient age, sex, comorbidity (as per Charlson Comorbidity Index<sup>15</sup>), and ocular comorbidity. Baseline best-corrected visual acuity (BCVA) was considered to be 20/20 unless otherwise reported. Injury data collected included etiology, type, and severity (as per Ocular Trauma Score<sup>16</sup>) of occupational eye injury. Data on the use of eye PPE at the time of the injury were also collected. If there was no documentation of eye PPE use in the medical record, it was presumed that no eye PPE was worn. Patients who used only prescription eyewear at the time of injury were not documented as wearing eye PPE, as such eyewear does

**Table 1—Patient characteristics**

Patient characteristic	Overall
Sex	
Male, n (%)	156 (92.3)
Female, n (%)	13 (7.69)
Age, mean (standard deviation)	33.8 years (11.6)
CCI, median (range)	0.00 (0–2)
Previous ocular comorbidity	
Amblyopia, n [%]	6 (3.55)
Previous trauma	
Previous foreign body, n [%]	28 (16.6)
Unspecified, n [%]	6 (3.55)
Previous refractive surgery, n [%]	2 (1.18)
Glaucoma or suspected glaucoma, n [%]	1 (0.592)
Other, n [%]	1 (0.592)

CCI, Charlson Comorbidity Index.

not meet the Canadian Standards Association (CSA) eye PPE standards.<sup>8</sup> Outcome data, including disposition, duration of follow-up, and BCVA at the time of last follow-up, were also recorded.

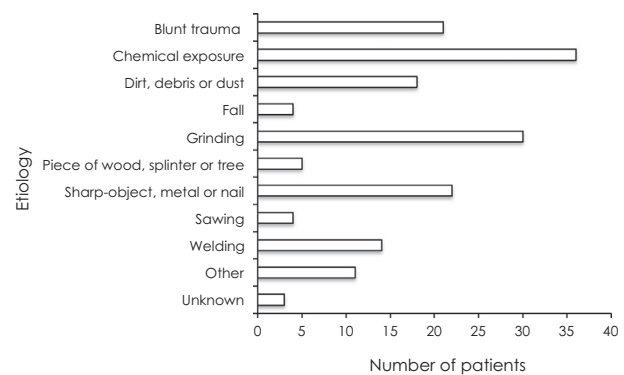
### Statistical analyses

Patient characteristics were summarized by using descriptive statistics. Medians between groups were compared by Mann-Whitney U tests.  $\chi^2$  analyses were used to compare proportions as indicated. Multivariate analyses conducted included logistic regression. All analyses were conducted by using SPSS 23.0 (IBM Corp: Armonk, N.Y.).<sup>17</sup>

## RESULTS

One hundred sixty-nine patients were included in this study. The median age of the cohort was 31 years (range, 17–68 years), and 92.9% were male. The median Charlson Comorbidity Index of the cohort was 0.00 (range, 0–2). Previous foreign body was the most common ocular comorbidity recorded (Table 1).

Chemical exposure (31.4%) and grinding (17.9%) were overall the most common etiologies of injury, followed by injuries sustained from sharp-objects, metals, or nails (13.1%). Sawing (2.4%) and falls (2.4%) were overall the



**Fig. 1—Etiologies of occupational eye injuries.** Each bar denotes the number of patients presenting with an occupational eye injury sustained by each etiology.

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