

Prevalence of ocular injuries, conjunctivitis and use of eye protection among dental personnel in Riyadh, Saudi Arabia

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Aims: To find out the prevalence of ocular injury and infection among dental personnel in Riyadh, Saudi Arabia. **Participants:** Two hundred and four dental personnel. **Method:** A questionnaire completed by researchers and observation during practice. **Results:** The response rate was 81%. Dentists and dental technicians had a similar prevalence (42.3%) of foreign bodies in their eyes during the period of one month. Almost 50.5% of dentists rarely had foreign bodies in their eyes, while only 22.2% of dental technicians claimed the same. The majority of dental surgery assistants (73.6%) never experienced foreign bodies in their eyes. Only 27.0% of female personnel had foreign bodies in their eyes as compared to 73.0% of male personnel, while only 28.5% of females had conjunctivitis as compared to 71.4% among male personnel. 75% of regular eye protector wearers (EPW) never had foreign bodies while 67.2% EPW never had conjunctivitis. Dental technicians were more prone to ocular injury, 13.8% as compared to 4.4% of dentists. Only 30% of the regular eye protector wearers suffered ocular injury. **Conclusions:** Protection of the eyes should be emphasised and practised at undergraduate level. The awareness of eye protection should be highlighted at all clinical and research symposia. Further studies should be conducted to assess the financial implications of ocular injuries and infections in dental institutions and practices. Recommendations are made for universal precautions and the observation of safety at work guidelines by all dental team members.

Key words: Ocular injuries, dental personnel, dental team, occupational hazards, safety at work

The dental office can be a source of ocular injury due to mechanical, chemical, microbiological and electromagnetic insult. Accidents resulting in injury to the eye and face of dentists, auxiliaries and the patient can occur at any time.

Recently, ocular injuries have been reported from different industrialised countries^{1–4}. Cronstrom *et al.*¹, reported from the claims submitted to the Swedish Patient Insurance Scheme that there were two cases of particles dropped into patients' eyes. McDonald *et al.*², reported that overall, dental chairside assistants experienced a higher incidence of injuries than students both on a per worker and per time basis. Of the injuries with a low risk of cross-infection, burns and scalds from sterilising equipment, and eye injuries in the laboratories were the most common. In another study Sims *et al.*³ reported that out of 241 orthodontists 43 per cent reported instances of ocular injury in their practices. The majority of these injuries occurred during debonding, or trimming acrylic. Other incidents involved ligating materials, intra-oral polishing, and acid etching. Porter *et al.*⁴ reported that eye injuries accounted for 10 per cent of some 300 accidents reported over a period of nine years at a

dental hospital. Serious complications were rare, but many of the injuries could have been avoided.

Apart from mechanical trauma from steel, gold or amalgam particles, dental personnel are at high risk of microbial infection from saliva, blood, calculus and infected tooth material. Dental turbines create aerosols of bacteria in areas up to four feet from patients' mouths^{5,6}. At a normal working distance, there is no zone of safety from organism bearing droplets⁷ and bacteria may remain in suspension in the air for up to 30 minutes⁸. There is a risk that the protective mechanisms of the eye may be overwhelmed by such high concentrations of pathogens.

The eyes, in particular, are also at risk from various chemicals used in clinical dentistry, particularly sodium hypochloride and phosphoric acid, trichloroacetic and chromic acids. Laboratory materials constitute a more significant hazard. Apart from acids, methyl methacrylate monomer, if splashed into the eye, can cause a painful reaction⁹. Plaster of Paris contains small quantities of lime and quartz, which can damage the eye; whilst pumice can abrade it^{10,11}.

Among eye infections, Herpetic Keratitis is one of the worst that can be contracted by clinical dental staff, but bacterial conjunctivitis caused by *Staphylococcus aureus* is more common¹¹. Other conjunctival pathogens such as *Chlamydia trachomatis* have been reported, although rarely, to have been transmitted in dental practice¹².

Roberts-Harry *et al.*¹⁷ reported that 3.9 per cent of 205 dentists had suffered from conjunctivitis and it was concluded that wearing eye protection reduces incidence of eye injury. Dental personnel work frequently with rotating and sharp instruments and various fairly noxious materials, and they are not infrequently exposed to the risk of burns¹¹. With air turbine speeds of 250,000 to 400,000 rev/min, small particles can be projected at veloci-

ties of up to 10m/s^{ref13} and if they hit the eye, can cause at least conjunctivitis, but more importantly, corneal abrasions or even dangerous penetrating wounds^{14,15}. There are also risks from projected particles produced when grinding metals or plastics or cutting wire, and dental staff have been wounded in this way. Some have been permanently blinded as a consequence^{10,16}.

Staffanou *et al.*¹⁸ reported that dental laboratory technicians are at risk from the continual exposure to light radiation from molten metal during casting and soldering procedures. Palenik¹⁹ has advocated safer working environments to give protection from traumatic injuries due to projectiles or through exposure to harsh chemicals or heat, and infections from contact with patient body fluids. He also emphasised that laboratories must comply with safety mandates in the most effective and efficient manner.

The aims of this study were to assess the prevalence of ocular injuries and infection in dental practices in Riyadh and to introduce an awareness among dental surgeons, dental surgery assistants (DSA), hygienists (DH) and dental technicians (DT), of the risks of ocular trauma and infections. The other aim of this study was to highlight the need of observance of universal precautionary measures and safety at work guidelines in both government and private dental care sectors.

Material and methods

Riyadh City has about five hundred dental clinics in government and private sectors, into which there has been lot of investment. Two hundred and fifty questionnaires were distributed to the dental departments at Riyadh Armed Forces Hospital, Riyadh Medical Complex, King Saud University Hospital, Primary Health Care Centers and private dental clinics in Riyadh. The questionnaires were

completed by examiners by interviewing the dental personnel. They were also observed during their routine practice and laboratory procedures. The observation was felt necessary to have an idea about their routine practice of wearing eye protectors and answering the questionnaire. The respondents were a convenient sample without any randomisation. The selection of the dental personnel was based on the willingness of the participants to take part in the study. A pilot study was conducted on 20 subjects to test the convenience of questionnaire and inter-examiner variability. The inter-examiner agreement was 90 per cent and the questionnaire was found convenient for dental personnel to answer. The data were entered and analysed by SPSS version 9.1.

Results

Two hundred and four subjects answered the questionnaire. The response rate was 81.6 per cent. The dental personnel distribution was as following: Dentists 91 (44.6 per cent), DSA 72 (35.3 per cent), DT 29 (14.2 per cent), DH 12 (5.9 per cent). Eighty seven subjects (42.6 per cent) were male and 117 (57.4 per cent) were female (*Table 1*).

The prevalence of having experienced a foreign body in the eye and the occurrence of conjunctivitis among dental personnel is given by job description and gender with a history of one month (*Tables 2 and 3*). It was found that there was a statistically significant difference among dental personnel for both prevalence of foreign body and conjunctivitis. Dental technicians were more prone to have experienced a foreign body in the eye. Both dentists and dental technicians were equal in number 11 (42.3 per cent) in this respect over a period of one month but there was significant difference in having rarely and never experienced this. That is, 50.1 per cent and 37.4 per cent of dentists had rarely and never suffered this, in

Table 1 Classification of dental personnel by gender

Profession	Male	Female	Total (%)
Dentist	53	38	91 (44.60)
Dental Surgery Assistant	5	67	72 (35.30)
Dental Technician	24	5	29 (14.20)
Dental Hygienist	5	7	12 (5.90)
Total	87 (42.60)	117 (57.40)	204 (100)

Percentages in parenthesis (%)

Table 2 The prevalence of foreign bodies and conjunctivitis among dental personnel

Prevalence	Foreign bodies (%)					Conjunctivitis (%)				
	Dentist	DSA	DT	DH	Total	Dentist	DSA	DT	DH	Total
In a month	11 (42.30)*	3 (11.50)	11 (42.30)	1 (3.80)	26 (12.75)**	4 (57.10)*	0 (0.00)	3 (42.80)	0 (0.00)	7 (3.43)**
Rarely	46 (50.55)	16 (22.22)	11 (37.93)	5 (41.67)	78 (38.24)	35 (38.46)	19 (6.39)	6 (20.69)	6 (50.00)	66 (32.35)
Never	34 (37.36)	53 (73.61)	7 (24.14)	6 (50.00)	100 (49.02)	52 (57.14)	53 (73.61)	20 (68.97)	6 (50.00)	131 (64.22)

$\chi^2 = 42.3500$ $P < 0.0001$
25% cells have expected frequency less than 5.

$\chi^2 = 13.5621$ $P = 0.034$
41% cells have expected frequency less than 5.

* % among subgroups
** % among total sample

Table 3 The prevalence of foreign bodies and conjunctivitis by gender

Prevalence	Foreign bodies (%)			Conjunctivitis (%)		
	Male	Female	Total	Male	Female	Total
In a month	19 (73.00)*	7 (27.00)	26 (12.75)**	5 (71.40)*	2 (28.50)	7 (3.43)**
Rarely	37 (42.53)	41 (35.04)	78 (38.24)	33 (37.93)	33 (28.20)	66 (32.35)
Never	31 (35.63)	69 (58.97)	100 (49.02)	49 (56.32)	82 (70.09)	131 (64.22)

$\chi^2 = 16.1205$ $P = 0.0003$

$\chi^2 = 5.3016$ $P = 0.07$
33% cells have expected frequency less than 5

* % among subgroups
** % among total sample

Table 4 The frequency of using eye protector by gender

Using eye protector	Male (%)	Female (%)	Total (%)
Routinely (regular)	49 (56.32)*	76 (64.96)	125 (61.27)**
Not routinely (irregular)	38 (43.68)	41 (35.04)	79 (38.73)

* % among subgroups
** % among total sample
 $\chi^2 = 1.2253$ $P = 0.2683$

comparison to dental technicians reporting 37.9 per cent and 24.1 per cent respectively (Table 2).

Regarding conjunctivitis, there was not a very significant difference among personnel but dental assistants and dental hygienists had a better record as compared to dentists and dental technicians (Table 2).

With regard to the prevalence of foreign bodies in the eye, 73 per cent of males had a history of this compared to 27 per cent female

dental personnel and similar results were found in the case of conjunctivitis, while comparing prevalence of foreign body and conjunctivitis by gender (Table 3).

The frequency of wearing eye protectors (safety glasses and shields) was more common among female 65 per cent as compared to male 56 per cent, with a statistically significant difference (Table 4). It was obvious that the prevalence of foreign body and conjunctivitis was less common, 38 per cent and 14.3 per cent among

regular users, as compared to 61.3 per cent and 85.7 per cent among irregular users of eye protectors (Table 5).

The prevalence of ocular injury was higher (8.04 per cent) in males as compared to (2.6 per cent) females. The highest prevalence of ocular injury was among dental technicians as compared to dentists, 13.8 per cent and 4.4 per cent respectively (Table 6). The prevalence of ocular injury was 30 per cent in regular wearers as compared to 70

Table 5 The prevalence of foreign body and conjunctivitis with the frequency of wearing eye protectors

Prevalence	Foreign bodies (%)			Conjunctivitis (%)		
	Regular EPW	Irregular EPW	Total	Regular EPW	Irregular EPW	Total
In a month	10 (38.19)*	16 (61.30)	26 (100.00)**	1 (14.28)*	6 (85.70)	7 (100.00)**
Rarely	40 (51.28)	38 (48.71)	78 (38.24)	36 (54.54)	30 (45.46)	66 (32.35)
Never	75 (75.00)	25 (25.00)	100 (49.02)	88 (67.18)	43 (32.82)	131 (64.21)

$\chi^2 = 16.9239$ $P = 0.0002$ $\chi^2 = 9.6953$ $P = .0078$
 33% cells expected frequency less than 5

* % among subgroups
 ** % among total sample
 EPW; Eye Protection Wearers

Table 6 The prevalence of ocular injury with gender and dental personnel

Prevalence	Ocular injury (%)		Ocular injury (%)				Total
	Male	Female	Dentist	DSA	DT	DH	
Yes	7 (8.04)*	3 (2.56)	4 (4.40)*	1 (1.39)	4 (13.79)	1 (8.33)	10 (4.90)**
No	80 (91.95)	114 (97.43)	87 (95.60)	71 (98.61)	25 (86.21)	11 (91.67)	194 (95.10)

$\chi^2 = 2.1481$ $P = 0.1427$ $\chi^2 = 7.1771$ $P = 0.066$
 25% cells expected frequency less than 5 50% cells expected frequency less than 5

* % among subgroups
 ** % among total sample

Table 7 The prevalence of ocular injury with the frequency of wearing eye protectors

Ocular injury	Eye protection (%)		Total
	Regular	Irregular	
Yes	3 (30.00)	7 (70.00)	10 (4.90)
No	122 (62.89)	72 (37.11)	194 (95.10)

$\chi^2 = 3.06$ $P = .08$ 50% cells have expected frequency less than 5

Table 8 Frequency of visiting ophthalmologist with foreign body and conjunctivitis

	Yes	No
Foreign body	10 (9.62)	94 (90.38)
Conjunctivitis	26 (35.62)	47 (64.38)

$\chi^2 = 16.33$ $P < 0.0001$
 with Yates correction

per cent in irregular wearers of eye protectors (Table 7). Only 9.6 per cent of the subjects experiencing a foreign body visited ophthalmologists, while 35.6 per cent of the personnel visited an ophthalmologist with conjunctivitis, for treatment (Table 8).

Discussion

The limitations of the study are two-fold. Firstly, the sample study was a convenience sample based on the willingness of respondents to participate, and secondly the data

contains only the history of occurrence of foreign body to eyes and conjunctivitis for a one month time period. There is the possibility of bias resulting from the convenience sampling technique.

The eighty one per cent response rate was good and was achieved by personally completing the questionnaire through interviewing the dental personnel. Nineteen per cent of the subjects declined at the last moment due to lack of time. The direct observation technique was used to assess any discrepancy between the

reported and actual practice of use of eye protection measures. Surprisingly no difference was found, perhaps due to direct observation, which might have had some influence on reporting.

The results of the study indicate that almost 51 per cent of the total subjects and 62.6 per cent of the dentist subjects suffered at least one episode of foreign bodies in their eyes and 35.8 per cent of the total subjects and 42 per cent of the dentists suffered with conjunctivitis. The incidence of trauma and infection is higher than the findings of Roberts-Harry *et al.*¹⁷, where only 14 per cent and 3.9 per cent had such an incidence of foreign body and conjunctivitis respectively.

In our study the dental technicians had significantly higher incidence of foreign body 75.8 per cent, followed by dentists 62.6 per cent, dental hygienists 50.0 per cent and dental assistants 26.4 per cent. Also, dental technicians had a significantly higher incidence of ocular injury, 13.8 per cent compared with others who reported only 8.3 per cent dental hygienists, 4.4 per cent dentists and 1.4 per cent dental assistants. This indicates

the negligence and the high risk environment of dental technicians i.e. metal particles, acrylic, gypsum products, fractured discs instruments, and so forth.

Dental hygienists and dentists had a higher incidence of conjunctivitis (at least one episode) 50.0 per cent and 42.9 per cent respectively. It shows that they are more at risk to the polluted oral environment than dental technicians and dental assistants.

There is an interesting tendency in that female personnel suffered with foreign body, ocular injury and conjunctivitis significantly less than males. This is attributed to the regular wearing of eye protectors, practised more in female than by male personnel. Generally females tend to have better working environments than males. The results showed that wearing eye protectors reduces the possibility of having a foreign body in the eye, ocular injury and conjunctivitis. Seventy five per cent of those who had never had an ocular injury and 67.2 per cent of those who never had conjunctivitis were regularly wearing eye protectors. It is also seen that more sufferers of conjunctivitis visited an ophthalmologist as compared to subjects suffering from a foreign body.

The overall incidence of 5 per cent of the subjects with ocular injury in this study is less than reported by Porter *et al.*⁴. That may be due to the longitudinal accumulation of cases over a period of nine years or a lack of reporting of injuries in Riyadh. There is a need for a longitudinal study of ocular injuries in dental practices to compare the annual trend of clinical accidents.

In our study, which involved small numbers, the injuries reported were minor; nevertheless, they could cause considerable discomfort and necessitate time off work with resultant loss of earnings. In future studies these aspects should be addressed. More serious injuries can result in permanent impairment

of sight, either as a result of the trauma or infection caused by the injury or due to long term complications, including cataract, glaucoma, retinal detachment or other sight threatening complications that could occur due to the toxic effect of retained intra-ocular metals. There are aspects of permanent blindness as a consequence of eye injuries^{10,16}. Rarely, sympathetic ophthalmitis can affect the uninjured eye, this is a condition in which injury to one eye sets up an inflammation in both eyes, resulting in bilateral blindness¹⁰. One Italian study suggested 18 per cent of dentists to have had eye lesions caused by foreign bodies¹⁶. Ocular injuries can lead to a range of factors which contribute to the calculation of indirect costs in the dental work place².

The universal precautions for eye protection may help in avoidance of eye injury or infection but do not provide a guarantee of total safety from foreign bodies or conjunctivitis. Close viewing and treating anterior teeth increase the exposure to missile damage. Eyes must be protected from foreign bodies, infected material, chemicals, and the various forms of radiation. Some 53 per cent of dentists wear glasses because of sight defects¹⁰, but the simplest and most effective methods of preventing eye injury is the use of proper protective spectacles preferably with plastic lenses and side shields. In the laboratory, a plexiglass shield will reduce splatter and flying particles, and appropriate dust extraction should be used whilst grinding and polishing appliances. Face protectors such as the Zephyre (Racal Ltd, Wembley, UK), have the advantage of giving a flow of filtered cool air to the operator and protecting the eyes and respiratory system simultaneously⁴.

There was no history of permanent injury to eyes in this study. All dental personnel should be familiar with first aid measures and the location of a stock of suitable eye irrigants. This may prevent serious complications in case of eye injury or conjunctivitis. To avoid the unfore-

seen serious situation, the universal precautions should be adopted in routine clinical and dental laboratory procedures. This may help in better and healthier, low risk working environments with the notion of safety at work.

Conclusion

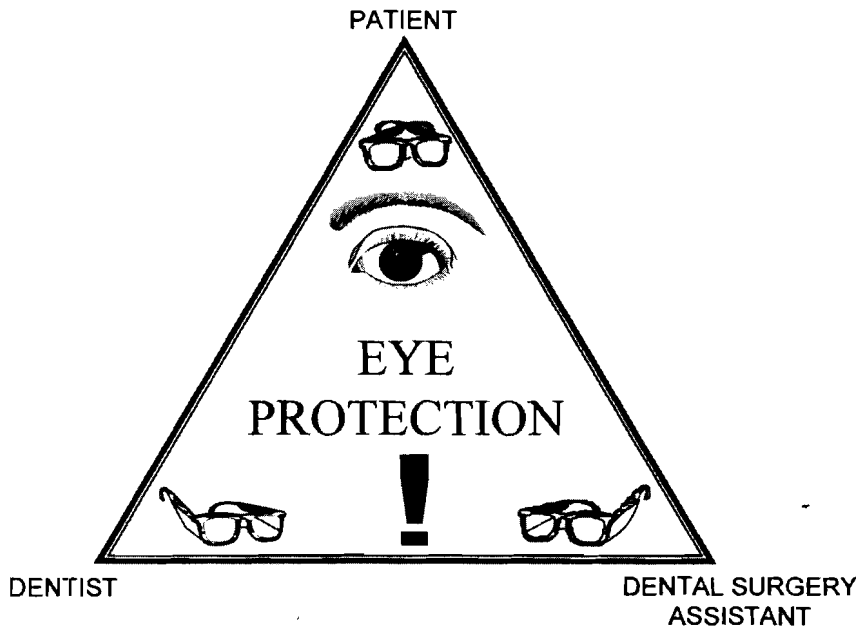
Within the limitations of the study, the following conclusions were drawn:

- Dental technicians were prone to have more foreign bodies and conjunctivitis as compared to other dental personnel.
- Dental assistants and dental hygienists had a better record of eye protection (free from conjunctivitis) as compared to dentists or dental technicians.
- Females had a lower prevalence than males regarding foreign bodies, conjunctivitis and ocular injury.
- Female dental personnel were regular users of eye protectors as compared to males.
- The prevalence of foreign body and conjunctivitis was high among irregular eye protection wearers.
- Dental surgery assistants had the safest record of being free from ocular injury (98.6 per cent).
- Almost one third of the regular eye protection users had ocular injury and one third with conjunctivitis visited an ophthalmologist.

Recommendations

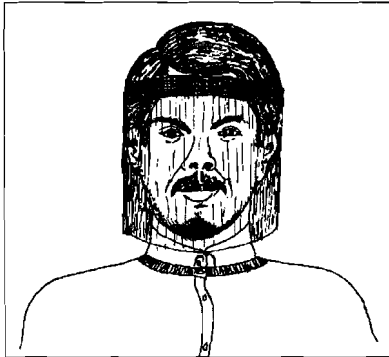
It is recommended that dental technicians should observe and adhere to the universal precautions especially with eye protection and face shields. The need for eye protection for dentists, and other dental personnel should be emphasised in all dental working places (*Figures 1 and 2*).

Dentists should take the responsibility for their team for occupational safety and hazard free working environments, with first aid available. The awareness of self-



PROTECT YOUR EYES!

Figure 1



PROTECT YOUR EYES!

Figure 2

protection should be highlighted at all clinical and research symposia and meetings. The cost-benefit analysis should be used as a positive motive for behaviour change among dental personnel. Protection of the eyes should be emphasised and practised at undergraduate level (safety glasses, face shields etc.). In the case of an eye injury or infection, it should be reported and registered at the workplace. Further studies are needed to assess the financial implications of ocular injuries or infections in dental institutions and practices.

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