Original Article

A Clinico-Epidemiological Study of Ocular Trauma in Indian University Students

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Purpose: To observe the pattern, severity and outcome of ocular injuries and to identify the etiological factors responsible for ocular trauma among University students.

Material and Methods: This prospective interventional study was conducted in university students health care complex and department of ophthalmology, Institute of Medical Sciences, Banaras Hindu University, Varanasi from September 2009 to August 2011. One hundred and sixty six university students with eye injuries attending as outpatient or emergency patient were thoroughly examined as per standard clinical procedures to identify the cause, type, extent and severity of injuries and impact on vision. The follow up period was six months.

Results: Out of the 166 patients, 117 (70.48%) were male while 49 (29.52%) were females. Patients were aged between 16 and 45 years. 67.47% were delegacy students while 32.53% were hostellers. Mechanical injuries accounted for 70.48%, while rest were chemical (11.44%), thermal (9.04%) and radiational injuries (9.04%). Most of the injuries occurred at workplace (25.90%) or on the road (25.30%), hostel/residence (21.69%) and during play and sports (19.28%). 79.29% students suffered accidental injuries and rest 27.71% had assault related injuries. The assault related injuries were more common amongst male students (21.69%). 56.02% of mechanical injuries were caused by blunt objects and rest 14.46% were due to sharp objects. Commonest type was periocular and lid injury (50%), followed by globe injury (44.58%) and orbital injury (5.42%). Left eye was affected in 42.77%, right eye in 34.94% while in 22.29% cases both the eyes were involved. 23.49% student suffered from severe injury, 36.49% had moderate while 40.96% sustained minor injuries. There was bimodal seasonal distribution with first spike during spring and second during rainy season. 73.49% of the injured patients were managed by conservative treatment while rest underwent surgical procedures. The final visual acuity was 6/18 or better in 60.24% patients between 6/18 to 3/60 in 24.11% and 3/60 or less in 12.65%. Assessment was not possible in 3.01% cases.

Conclusion: This study highlights epidemiology of ocular trauma in university students. Health education and preventive strategies should be focussed specially during workshop, laboratory work, in play ground and while driving.

Ocular injury remains an important cause of avoidable and predominantly, monocular visual impairment and blindness.[1,2] Management of ocular trauma has always been a challenge to ophthalmologist.[3] Eye injuries have significant impact on the individual and society in terms of morbidities, medical cost and loss of productivity, thereby affecting the quality of life. The

adverse consequences of ocular injuries like visual impairment and physical disfigurement can also isolate the patient socially by imposing a physical and psychological barrier.[4] Young adult males are more prone to ocular trauma as they indulge in high risk behaviours. A good proportion of work related, assault and sports related eye injuries were reported in young adult males.[5]

It has been estimated that 90% of all ocular injuries are preventable.[6] The formulation of preventive strategies need detailed epidemiological study of ocular trauma which varies in different countries and populations depending on geographical location, socioeconomic status and literacy level etc. The aim of this prospective study was to determine incidence, etiology, severity and outcome of ocular injuries amongst the university students.

Ocular injuries are one of the common causes of absence of students from classes and it also adversely affects the students performance and educational opportunities.

MATERIAL AND METHODS

This prospective interventional study was carried out at the university student's health care complex and department of Ophthalmology, Sir Sundar Lal Hospital, Institute of Medical Sciences, Banaras Hindu University, Varanasi over a period of two years, from 5.9.2009 to 4.8.2011. One hundred sixty six students, who presented with acute eye injuries at the outpatient or emergency OPD, were included as the study subjects. Patients with old ocular trauma, surgically treated elsewhere or those having co-existing vision threatening ocular disease were excluded from the study.

The study was approved by the research ethics committee of institute of medical sciences, Banaras Hindu University. A prior informed consent was obtained from the study subjects. The following demographic and clinical information was recorded for every study subject : age, sex, residence (hosteller / delegacy), educational status (Faculty and subjects), date, time, season and place of injury, circumstances leading to eye injury, type and manner of injury, the object causing ocular injury, history of alcohol consumption at the time of injury and use of protective eyewear. The patients were examined by standard ophthalmological procedures to note the areas injured, type and related injury, severity of injury and initial visual acuity. Radiological investigations, if indicated, for confirming foreign body and extent of injury, were performed. After confirming the diagnosis, patients were segregated in minor, moderate and severe group depending on threat to globe and potential for disfigurement (table 1). The study subjects were assessed for deciding the treatment modalities and prognosis. Finally, the visual outcome at the end of the treatment and during follow up was noted.

All this information was collected in a pre-designed and pre-tested Performa. The collected data was entered in the SPSS version 11.0. Categorical and numerical variables were analyzed as frequency and percentages. Chi – square test of significance was applied and p-value of less than 0.05 was taken as significant.

RESULTS

Out of the one hundred and sixty six students who presented with ocular injury during the study period, 117 (70.48%) were males and 49 (29.52%) were females. The two commonest affected age groups were between 26 to 35 years (43.37%) and 16 to 25 yeas (33.74%). 54 (32.53%) students were hosteller and rest 112 (67.47%) were residing outside the University campus. 76 (45.78%) were professional (technical) students who belonged to engineering, medical, management and research stream, while 90 (54.22%) were non-professional (non-technical) students from arts, social science and other allied subjects. 43 (25.90%) students were under the influence of alcohol when they sustained ocular injury. Only 13 (7.84%) patients had worn protective eyewear at the time of injury (Table 2).

The ocular injury occurred most often in males between the age of 26 – 35 years (29.52%) and 16 – 25 years (25.30%). Majority of female (n = 23, 13.86%) patients belonged to 26 – 35 years age group. The left eye was involved in 71 (42.77%) and right eye in 58 (34.94%), while 37 (22.29%) patients sustained bilateral eye injuries (Table 3). When place of injury was ascertained according to age distribution, it was found that commonest place of injury in all age group was place of work (25.90%) like department, laboratory, workshop etc., followed by road / street (25.30%), residence / hostel (21.69%) and place of sports or ground (19.28%) (Table 4). A bimodal seasonal distribution was observed with first spike between February to April and second between July to September (Fig. 1). Most common causes of eye injury amongst the University students was assault (n = 46,

Table 1: Eye injury according to severity

Injury type	Minor	Moderate	Severe
Injuries to globe	-Corneal abrasion -Foreign body on the eye -Traumatic-iritis -Scleral / conjuctival haemorrage	-Contusion of the globe -Hyphaema	-Open wound to the cornea -Scleral laceration -Perforating foreign bodies -Optic Nerve Injury -Alkaline burns -Traumatic Cataract -Retinal detachment
Orbital Fracture	Any orbital fracture unless	Blow out Fracture	-Extensive orbital fracture -Dehescent, unable to wire / plating
Periorbital Injuries	-Contusion -Abrasion -Laceration unless	Periorbial burn >2.5 cm or into subcutaneous tissue or contaminated or tissue avulsed, or more than two minor laceration	-Lid avulsion -Laceration with tear duct involvement

Table 2: Distribution of sex and literacy status according to age

Age Group (in year)	Male	Female	Unilateral only			Bilateral
	No. of Patient n (%)	No. of Patient n (%)	Right No. of Patient n (%)	Left No. of Patient n (%)	Total No. of Patient n (%)	No. of Patient n (%)
16-25	42 (25.30)	14 (8.43)	20 (12.04)	26 (15.67)	46 (27.71)	10 (6.02)
26-35	49 (29.52)	23 (13.86)	24 (14.46)	30 (18.07)	54 (32.53)	18 (10.85)
>36	26 (15.66)	12 (7.23)	14 (8.43)	15 (9.04)	29 (17.47)	9 (5.42)
Total	117 (70.48)	49 (29.52)	58 (34.94)	71 (42.77)	129 (77.71)	37 (22.29)

Table 3: Distribution of place of Injury according to Age group

Place	Age Group (years)			Total No. of Patient n (%)
	16-25 No. of Patient n (%)	26-35 No. of Patient n (%)	>36 No. of Patient n (%)	
Residence / Hostel	10 (6.02)	17 (10.24)	9 (5.43)	36 (21.69)
Work place (college / department / laboratory / workshop)	15 (9.04)	18 (10.84)	10 (6.02)	43 (25.90)
Road / Street / Highway	14 (8.48)	18 (10.84)	10 (6.02)	42 (25.30)
Place of sports and recreation	12 (7.24)	14 (8.43)	6 (3.61)	32 (19.28)
Others	5 (3.01)	5 (3.01)	3 (1.80)	13 (7.83)
Total	56 (33.74)	72 (43.37)	38 (22.89)	166 (100.0)

Table 4: Distribution of study subjects according to cause and severity of injury

Causes / Circumstances of injury	Severity			Total n (%)
	Minor n (%)	Moderate n (%)	Severe n (%)	
Assaultive injury	21 (12.66)	16 (9.64)	9 (5.42)	46 (27.71)
Vehicle accident	8 (4.82)	11 (6.63)	12 (7.23)	31 (18.67)
Sports and Recreational	8 (4.82)	9 (5.42)	6 (3.61)	23 (13.85)
Falls	10 (6.02)	5 (3.01)	4 (2.41)	19 (11.45)
Chemical injury	6 (3.61)	10 (6.02)	3 (1.81)	19 (11.45)
Radiation injury	9 (5.42)	3 (1.81)	3 (1.81)	15 (9.04)
Others	6 (3.61)	5 (3.01)	2 (1.20)	13 (7.83)
Total	68 (40.96)	59 (35.54)	39 (23.49)	166 (100)

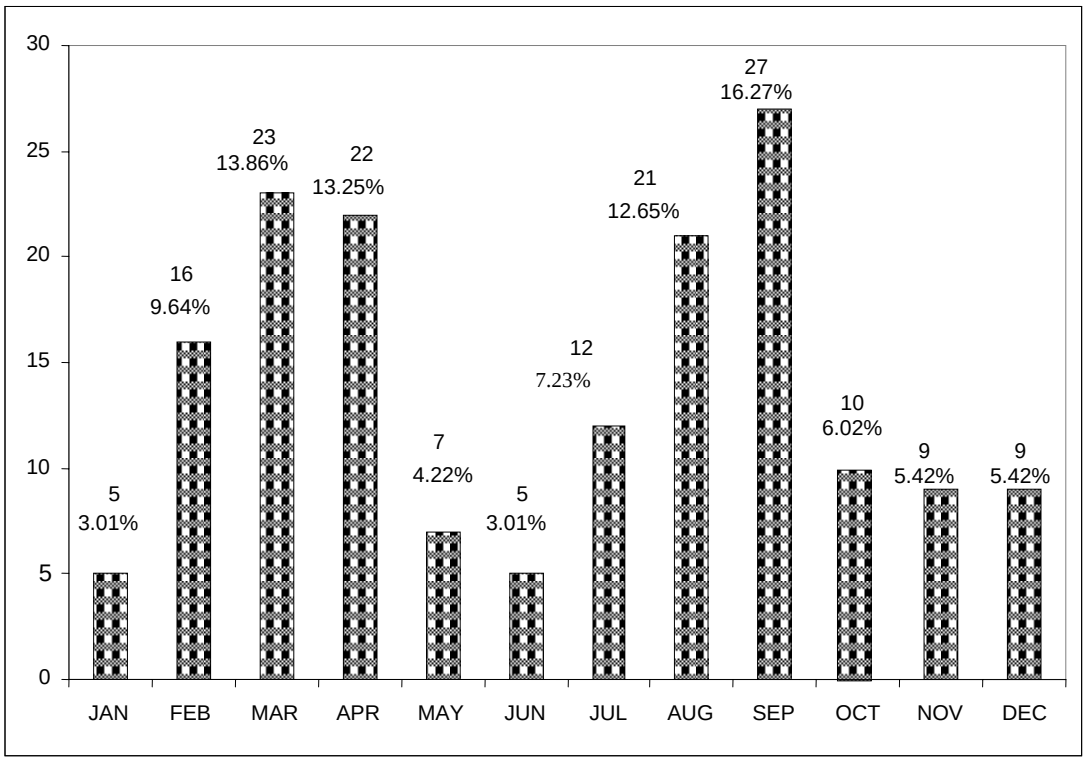


Fig. 1: Month wise distribution of ocular injury.

27.71%) followed by road traffic accident (n = 31, 18.67%), sports and recreational activities (n = 23, 13.85%) and accidental fall (n = 19, 11.45%). However, in 19 (11.45%) students, injury resulted from chemical exposure and in 15 (9.04%) cases it was radiational injury (Table 5). The most common source of injury was mechanical (n = 117, 70.48%) followed by blunt trauma (n = 83, 50%) and 24 (14.46%) by sharp objects, the remaining 10 (6.02%) were indeterminate. Commonest type of injury was periocular and lid (n = 83, 50%) (Fig. 2 and 3) followed by globe (n = 74, 44.58%) and orbital injuries (n = 9, 5.42%) (Fig. 4). Amongst the periocular and lid injuries, 20 (12.05%) had contusion, 15 (9.04%) had lacerated wound while 22 (13.25%) cases sustained burn. Amongst the open globe injuries (n = 30, 18.07%), 11 (6.63%) had corneal/ corneo-scleral laceration, 13 (7.84%) had penetrating injury with or without lens/uvea involvement while 6

Table 5: Characteristics of study subjects

Characteristics	No of Patients n (%)
Total	166 (100)
Gender	
• Male	117 (70.48)
• Female	49 (29.52)
Age group (in year)	
• 16-25	56 (33.74)
• 26-35	72 (43.37)
• > 36	38 (22.89)
Classification of Students	
• Professional (Technical	76 (45.78)
• subjects)	
• Non-Professional (Non-	90 (54.22)
• Technical subjects)	
Use of protective eye wear	
• Yes	13 (7,84)
• No	118 (71.08)
• Uncertain	35 (21.08)
Consumption of alcohol during injury	
• Yes	43 (25.91)
• No	101 (60.84)
• Uncertain	22 (13.25)
Source of Injury	
• Mechanical	117 (70.48)
❖ Blunt Object	83 (50)
❖ Sharp Object	24 (14.46)
❖ Indeterminate	10 (6.02)
• Chemical	19 (11.44)
• Radiational	15 (9.04)
• Thermal / Fireworks	15 (9.04)
Type of Injury	
• Periocular	83 (50)
• Globe injury	74 (44.58)
❖ Open	30 (18.07)
❖ Close	44 (26.51)
• Orbital Injury	9 (5.42)
Laterality	
• Unilateral	129 (77.71)
❖ Right eye	58 (34.94)
❖ Left eye	71 (42.77)
• Bilateral	37 (22.29)

(3.61%) cases had ruptured globe (Fig. 5). Closed globe injury accounted for 44 (26.51%) including lamellar laceration in 7 (4.22%) and contusion in 38 (22.89%) cases (Table 6).

The most commonly involved structure of eyeball was anterior segment (n = 50, 30.12%) while posterior segment abnormalities were present in 24 (14.4.6%) cases. 39 (23.49%) students suffered severe injury, 59 (35.54%) had moderate while 68 (40.96%) had minor injuries. Most of the severe injuries among the

Table 6: Characteristics of study subjects

Type of Injury	No of Patient n (%)
Periocular and lid injuries	83 (50)
• Abrasion	26 (15.66)
• Contusion	20 (12.05)
• Laceration	15 (9.04)
• Burn	22 (13.25)
Globe injuries	74 (44.58)
• Closed globe injuries	44 (26.51)
❖ Lameller laceration	38 (4.22)
❖ Contusion	20 (22.89)
* Hyphaema	10 (12.5)
* Lens dislocation / rupture	8 (6.02)
* Vitreous hemorrhage retinal detachment	19 (4.82)
❖ Chemical burns	
• Open globe injuries	30 (11.45)
❖ Laceration	11 (18.7)
❖ Penetrating injury with or	13 (6.63)
❖ without lens / uveal involvement	6 (3.61)
❖ Globe rupture	
Orbital injuries	9

Table 7: Treatment procedures undertaken

Treatment Procedures	No of Patients n (%)
Conservative / medical	122 (73.49)
Surgical	44 (26.51)
❖ Primary repair	21 (12.65)
❖ Secondary procedures	23 (13.86)
* Reconstructions / grafting	5 (3.01)
* ECCE + PCIOL	8 (4.82)
* Orbital Surgery	4 (2.41)
* Vitreoretinal Surgery	4 (2.41)
❖ Evisceration	2 (1.87)

(a) (b)

Fig. 2: (a) Pre and (b) Post operative photograph of a student having left eye lid and periocular injury

(a) (b)

Fig. 3: (a) Pre and (b) Post operative photograph of student having right eye lid injury

(a) (b)

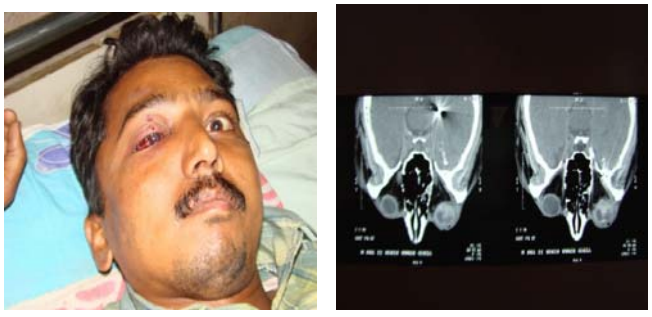
Fig. 4: (a) Photograph of student having left eye blow out fracture orbit due to assault with blunt object (b) CT Scan coronal view showing fracture floor of left orbit with soft tissue protrusion in left maxillary sinus.

students were caused by road traffic accidents (n = 12, 7.23%), assault injury (n = 9, 5.42%) (Fig. 5 and 6) and sports related events (n = 6, 3.61%) (Table 5). 133 (80.12%) study subjects were treated on outpatient basis and rest 33 (19.88%) cases required hospitalization. Five of them required emergency intervention. 122 (73.45%) students were managed by conservative treatment while the rest 44 (26.51%) had to undergo surgery. 21 (12.65%) study subjects needed

Table 8: Pre-treatment and Post-treatment visual status

Visual Acuity	Initial	Final
	No of Patients n (%)	No of Patients n (%)
6/6-6/18	86 (51.81)	100 (60.24)
<6/18-3/60	49 (29.52)	40 (24.11)
<3/60 - NPL	25 (15.06)	21 (12.65)
Unknown	6 (3.61)	5 (3.01)
Total	166 (100)	166 (100)

Fig. 5: Photograph of student having rupture globe



(a) (b)

Fig. 6: (a) Photograph of student having gunshot injury right eye (b) CT scan axial view of same patient showing penetrating injury right globe.

only primary wound repair. (n = 23, 13.80%) required secondary procedures including skin grafting (n = 5, 3.01%), cataract extraction with lens implantation (n = 8, 4.82%), vitreoretinal surgery (n = 4, 2.41%),

orbital surgery (n = 4, 2.41%) and evisceration (n = 2, 1.20%).

Upon initial presentation, (n = 74, 44.58%) had visual impairment (VA<6/18) out of which 25 (15.06%) were blind (VA< 3/60). 86 (51.81%) had normal vision (VA 6/6 to 6/18). Assessment of visual acuity on initial visit was not possible in 6 (3.61%) serious patients. On final follow up, the number of visually impaired patients had fallen to 61 (36.76%) and blind cases to 21 (12.65%).

DISCUSSION

Although ocular injury is an important cause of preventable unilateral loss of vision, particularly in developing countries[7], relatively few epidemiological studies have been carried out in developing countries. Young adult males carry the highest incidence of ocular injuries.[8] In our studies 77.11% students were below 35 years of age out of which 43.3.7% were between 26 – 35 years of age and 33.74% between 16 – 25 years. Our study showed male predominance with male / female ratio being 2.4/1. Other studies revealed a male:female ratio of 4:1 (Babar et al.)[9], 3:1 (Jahangir et al)[10] and 5.25:1 (Arfat MY et al)[11]. Some authors[2,12-14] have also reported age and gender pattern comparable to our study. Our observation indicates that male students were more exposed to outdoor activities.

Maximum (67.47%) students who sustained ocular injuries were residing outside the university campus. They usually traveled long distance and thus exposed to vehicular and projectile object related ocular injuries. The frequency of ocular trauma was higher in the left (71; 42.77%) as compared to right eye (58; 34.94%). It may be due to high (27.71%) assault related injuries in this study. Groessl et al.[15] and Shephered et al[16] reported high proportion of left eye involvement in assault related ocular and facial injury. This may be due to the fact that a right handed assailant can more easily strike the left side of the face of victim. However, Arfat M.Y. et al.[11] reported high proportion of right eye injury (66%). The frequency of bilaterality was 22.29% in our study in contrast to findings of Babar T.F. et al.[17] (2.9%) and Jahangir T. et al.(3%)[10]. This is probably because most of our injury cases were as a result of assault, road traffic accident, fall and chemical or thermal exposure.

It was observed that most common place of injury was the place of work (25.90%) like laboratory, workshop and department etc. followed by road or street (25.30%), at home / hostel (21.69%) and place of sport or recreation (19.28%). Other researchers reported home as the commonest place of injury [Thompson et al.[6] (58%), Luff et al.[18] (34%), Kuhn et al.[19] (43%) and MacEwen et al.[20] (51%). Work related injuries were reported to be the commonest cause of eye injury in adults.[21-23]

Bimodal trend of seasonal distribution was observed with first spike between February to April (spring) and second between July to September (rainy). Mackiewicz et al[24] and Keklikci U et al.[25] reported peak ocular injures in summer months when schools have holidays and students indulge more in outdoor games. Gyasi M.E. et al.[21] from Ghana reported bimodal pattern between March to may and September to November which is the actual farming and harvesting season in this country. Canavana Y.M. et al.[26] from Ireland reported high incidence of ocular injury due to sports and domestic or agricultural accidents in winter season in contrast to our study in which incidence of injury was least in winter due to cold weather and students examination time and in month of May & June when University was closed due to summer vacation.

Assault has been recognized as a frequent and serious cause of eye injury in young adults.[15,22,27,28] Groessl et al.[15] reported incidence of assault related ocular injuries ranging from 1% to 53%. In our study also commonest cause of ocular injury was assault (n = 46, 27.71%), which reflects increasing trends of personal conflicts among the University students. Similar incidence was reported in previous studies of Dannenberg A et al.[29] (22%), MacEwen et al.[20] (18.6%), Niiranene M. et al.[30] (27%) and Gilbert et al.[31] (30%). However, higher incidence of assault related eye injuries were reported in US (41%) by Liggett et al[32] in war prone countries like Israel (34%) by Scherf and Zonis[33] and in Lesotho (53%) by Gordon and Mokete.[34]

Second common cause of ocular injury was road traffic accident (n = 31, 18.67%). Out of this majority (n = 20, 12.85%) were delegacy students probably as a result of fast, uncontrolled two wheeler driving and poor road condition in our district. Canavan Y.M. et al.[26] reported 32.5% and Mackay et al[35], 70% eye injuries as a result of road traffic accidents. Sport or play related injuries were third most common cause of ocular injury (n = 23, 13.85%) in our study. Similar observations were reported by Luff et al[18] (15%) and Kuhn et al.[19] (13%) Sechein et al[22] (34%) and Blomdahl et al[36] (23%) reported slightly higher incidence of sports related injuries.

Other important causes were chemical injury (11.45%) like acid or lime burn and radiation injury (9.04%) like infrared or ultraviolet Keratitis. Majority of these subjects were professional or technical students sustaining injury while working with chemicals and UV or infrared lamps in the laboratory. No eye protection was taken by 118 (71.08%) students at the time of injury. Our study emphasized the need to wear appropriate protective devices like safety goggles, helmet, UV protective shield and protective face-masks during driving, working in laboratory or workshop and while playing hockey / football or other games.

In our study, blunt injuries predominate (50%). In only 14.46%, injury was caused by sharp objects. This finding was consistent with those of MacEwen et al.[20] and contrary to the study of Jahangir et al[10] and Fasih et al.[37] in which most common source of injury was sharp objects. Most of our cases were of peri-ocular and lid injuries of minor severity. Blunt objects cause contusional posterior segment injury (4.82%) and ruptured globe (3.61%) while penetrating injury caused by sharp object (7.48%) results in severe ocular injury.

77.10% of the students having mild to moderate injury were managed by conservative/medical treatment or by minor surgical procedures without hospitalization, rest underwent surgical intervention after hospitalization. Final visual acuity was normal (6/6 to 6/18) in 60.24% visual impairment (<6/18 – 3/60) in 24.11% and blindness (<3/60 – NPL) in 12.65%. Visual outcome depends on the type and extent of injury and presence or absence of complications. In our study injury caused by blunt objects especially ruptured globe have worse prognosis than those caused by sharp objects. Similar findings were reported by other authors.[2,31,38] Complications like hyphaema, vitreous hemorrhage, retinal detachment and uveal tissue prolapse or incarceration were associated with very poor prognosis.[9,39]

CONCLUSION

This study has unveiled pertinent information related to causes, incidence and severity of ocular injury in young adults. The study also emphasizes the need to wear appropriate protective devices during work, play and driving because most of the ocular injuries were preventable. Though prevention of assault related eye injuries is more difficult than work and sport related eye injuries, Government and University administration could play important role in prevention of ocular injury by imposing / implementing protective eye health policies and strict rules against conflict / assault.

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