ORIGINAL RESEARCH

Evaluation of Ocular Injuries in Maxillofacial Trauma: A Prospective Study

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Abstract

Background: Midface fractures are mostly associated with orbital injuries, among these fractures, zygomaticomaxillary complex (ZMC) fractures are the most common fractures associated with orbital involvement. Injuries to midface usually destroy the integrity of the orbital skeleton and are often complicated by ocular injury.

Objective: The objective of the study is to determine the incidence and pattern of ocular injuries in maxillofacial trauma.

Materials and methods: The study included 88 patients from 5 to 65 years of age who sustained maxillofacial trauma with orbital involvement. A routine clinical and radiological examination and a thorough ophthalmologic examination were performed.

Results: Male predominance was noted (88.6%) and the majority of patients were found under the 16–25 years age group. RTA (72.7%) was the most common etiology for the injury followed by fall (20.5%). The ZMC fractures accounted for higher incidence of ocular injuries. Periorbital edema and ecchymosis were reported higher as extraocular injury. Loss of vision/blindness was observed in one patient.

Conclusion: Maxillofacial trauma, particularly midface trauma may affect the integrity of the orbital region resulting in orbital injuries. Prompt recognition and efficient ophthalmic examination must be done for each maxillofacial trauma patient in order to provide appropriate management and to avoid further ophthalmic complications also.

Keywords: Midface injury, Ocular injuries, Zygomaticomaxillary complex.

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Introduction

Vision is one of the most important senses present in the human body, which is executed by an eye. Nature has created unique protective features to protect the orbital globe from injury, the prominence of orbital bones, natural reflexes of self-protection, such as blinking, protecting the eye with the hand, averting the head, and resilient configuration of the globe as well as to allow it to withstand blows of considerable force without rupture. Also, a strong bony ring that covers the optic nerve in orbit leads to less chance of direct injury to the nerve.[1–3]

Evaluations of orbital injuries in association with maxillofacial trauma are very crucial as these injuries have a high risk of threatening vision. Midface fractures, for example, zygomaticomaxillary complex (ZMC), Le Fort II, Le Fort III, and NOE fractures are mostly associated with orbital injuries. Among these, the ZMC fractures are the most frequent ones. Injuries to the midface usually destroy the integrity of the orbital skeleton and are often complicated by ocular injury.[1] The reported incidence of ocular injuries in midface trauma ranges from 2.7 to 90.6%.[2,3] Classically, the main etiological factors for maxillofacial trauma are road traffic accidents (RTAs), sports injuries, mechanical/industrial hazards, animal hit, fall, and assaults.[4]

Vision loss in maxillofacial trauma is very uncommon with a reported incidence of 0.3–3.5%, characteristically due to the optic nerve or optic canal injuries, retrobulbar hemorrhage, and increased intraocular pressure, requiring prompt and aggressive intervention.[1,2] The present study was conducted to assess the incidence and pattern of ocular injury in maxillofacial trauma.

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Materials and Methods

A prospective observational study was conducted on 88 patients aged from 5 years to 65 years, and the patients were reported to O.P.D., Department of Oral and Maxillofacial Surgery, Maharishi Markandeshwar College of Dental Sciences and Research (MMCDSR) and Emergency Department of Maharishi Markandeshwar Institute of Medical Sciences and Research (MMIMSR). The study was done in collaboration with the Department of Ophthalmology, MMIMSR.

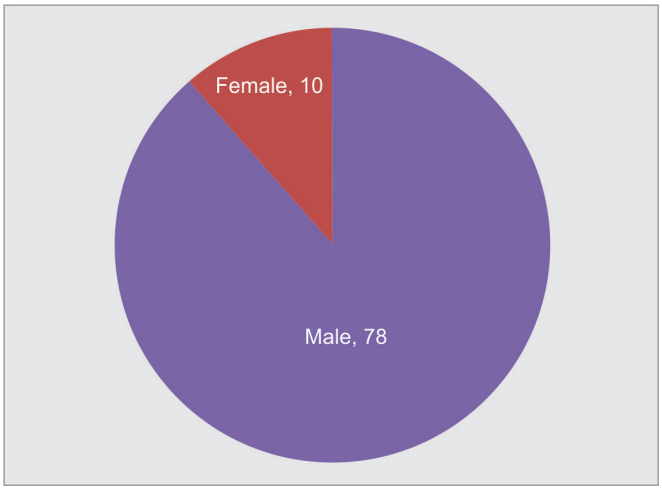

Fig. 1: Gender distribution

Table 1: Frequency distribution of subjects according to age

Age	*Frequency*	*Percent*
5–15 years	4	4.5
16–25 years	40	45.5
26–35 years	15	17.0
36–45 years	13	14.8
46–55 years	9	10.2
>56 years	7	8.0
Total	88	100

The study involved all patients who sustained maxillofacial trauma with orbital involvement. Ethical approval was taken from the Institutional Research Committee and Ethical Committee, MMDU, Mullana, Haryana, India.

All patients were examined clinically and routine radiographs, such as paranasal sinus view of the skull, submentovertex view/computerized tomography scan were obtained to confirm the diagnosis. A thorough ophthalmologic examination was performed. All the patients sustaining maxillofacial trauma with orbital injury were evaluated by an ophthalmologist to establish an early diagnosis. The variables include patients' age, gender, etiology, extraocular, and intraocular injuries.

Statistical Analysis

The data collected were tabulated and classified according to age, sex, etiology, type of fracture, and pattern of ocular injury and analyzed in Microsoft Office Excel 2007. Statistical Package for Social Sciences (SPSS) of version 19.0 was used for the data analysis.

Results

Males accounted 88.6% ($n = 78$) while females were 11.4% ($n = 10$) for all maxillofacial injuries (Fig. 1). The majority of patients were aged 16–45 years with the peak incidence occurring in the age group of 16–25 years (Table 1). The main cause of maxillofacial injury was a RTA followed by a fall (Table 2 and Fig. 2).

Among 88 patients with maxillofacial injuries, 19 patients were observed with midface fractures, 37 patients had mandibular fractures, 3 patients were found to have panfacial fractures, and the remaining were diagnosed to have only soft tissue injuries in the maxillofacial region. Midface fractures involved ZMC fractures either isolated or in combination with other midface fractures like Le Fort fractures. Mandibular fractures involved symphysis, parasymphysis, body, angle, and condylar fractures associated with soft tissue injury around the orbital region (Table 3).

Table 2: Distribution of subjects according to etiology of fracture

Etiology	*Frequency*	*Percent*
Assault	2	2.3
Fall	18	20.5
RTA	64	72.7
Sports injury	4	4.5
Total	88	100.0

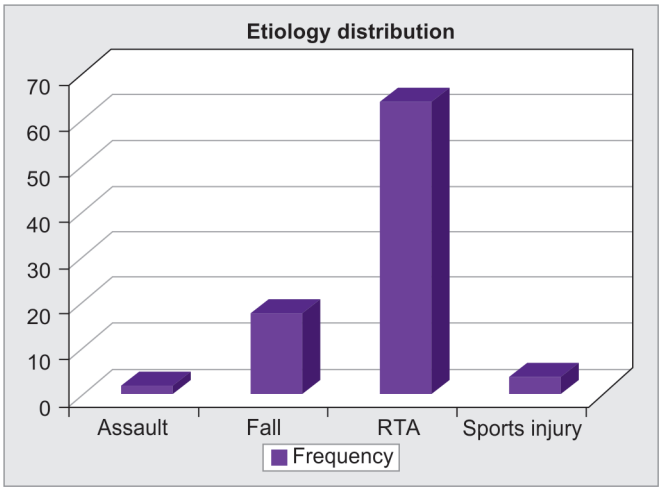

Fig. 2: Distribution of subjects according to etiology of fracture

Table 3: Distribution of subjects according to type of fracture

Type of fracture	*Frequency*	*Percent*
ZMC	15	17.0
Le Fort 1	2	2.3
Le Fort 2	2	2.3
Angle/body	8	9.1
Condylar/subcondylar	12	13.6
Symphysis/parasymphysis/ramus	25	28.4
Soft tissue injury	21	23.9
Panfacial fracture	3	3.4
Total	88	100.0

Ophthalmologic evaluation was performed in all maxillofacial trauma patients, and these injuries were divided into extraocular injuries or intraocular injuries. Periorbital edema and ecchymosis accounted higher as extraocular injury followed by subconjunctival hemorrhage and soft tissue injury involving the orbital region. Optic nerve damage was the major concern as intraocular injury and it was accounted for in one patient in this study, whereas enophthalmos was found in two patients. Detailed descriptions of extraocular and intraocular injuries are given in Table 4 and Figure 3. The distribution of subjects according to the type of fracture and pattern of ocular injuries are given in Table 5.

Table 4: Distribution of subjects according to patterns/type of ocular injuries

	Types of injuries	*Frequency*	*Percent*
Extraocular injuries	Periorbital edema and ecchymosis	28	31.8
	Subconjunctival hemorrhage	26	29.5
	Enophthalmos	2	2.3
	Anisocoria	0	0.0
	Chemosis	2	2.3
	Ptosis	0	0.0
	Restriction of extraocular movements	0	0.0
	Telecanthus	1	1.1
	Infra orbital nerve paresthesia	7	8.0
	Transient diplopia	1	1.1
	Lid laceration/soft tissue injury periorbital region	18	20.5
Intraocular injuries	Retrobulbar hemorrhage	0	0.0
	Optic nerve damage	1	1.1
	Retinal detachment	0	0.0

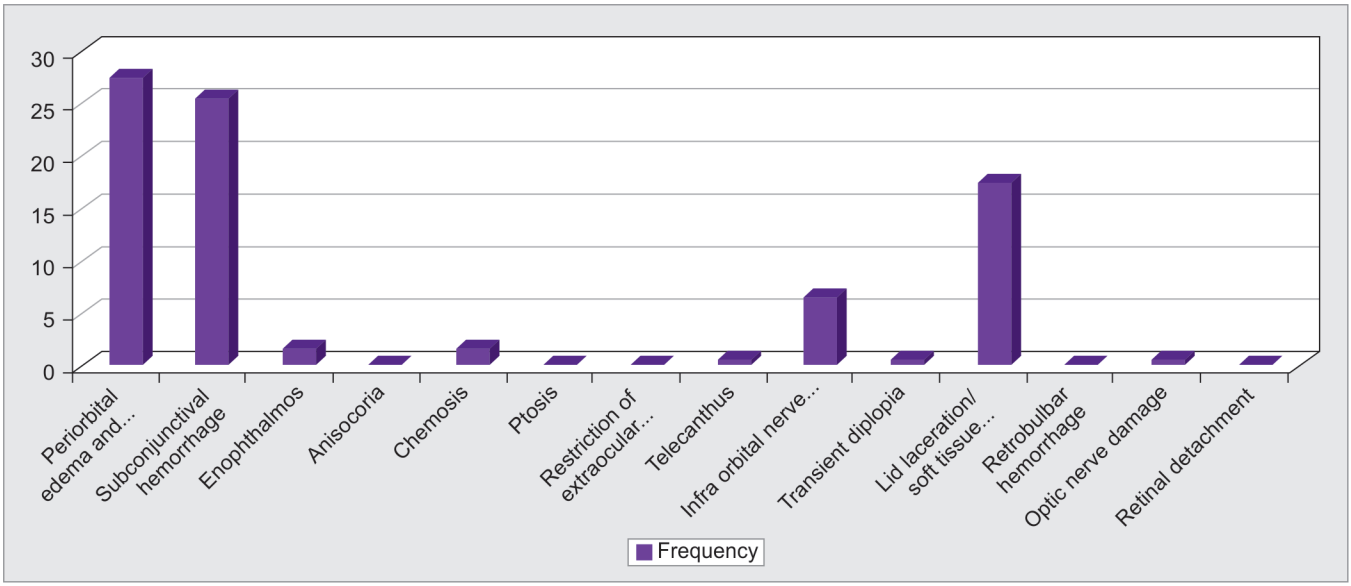

Fig. 3: Pattern/types of ocular injury with frequency

Discussion

Ocular injuries are frequently seen with maxillofacial trauma. Trauma to the maxillofacial region necessitates a careful attention in ocular examination; especially an evaluation of the vision acuity of each eye.[4] Maxillofacial trauma often destroys the orbital skeleton integrity and is complicated by eye injury which may result in vision loss. Prompt detection of ophthalmic injury is utmost important in maxillofacial trauma patients, especially in midface injuries.[2] Injuries to the eye globe and surrounding structures vary in severity. This may be simple lacerations of the lids, corneal abrasion to ruptures of the sclera, and intraocular hemorrhages, etc.[4]

Many studies described the ocular injuries in facial trauma and the reported incidence ranges from 2.7 to 90.6%.[2,5–9] The present study reported periorbital edema and ecchymosis as the most common orbital injury in maxillofacial trauma cases followed by subconjunctival hemorrhage which is concomitant with the study done by Rajkumar GC et al.[1] Conversely, Jamal BT et al.,[2] Dilip Septa et al.[10] and Umarane et al.[11] found subconjunctival hemorrhage as the most common orbital injury in 55%, 83.5%, and 61.8% of cases in their study, respectively. Subconjunctival ecchymosis is bright red colored and pathognomic of fracture of the orbital wall. The the resultant hemorrhage moves forward under the conjunctiva as much as avascular cornea edges.[1]

The higher incidence of maxillofacial trauma among males compared with females is a common finding in the available literature.[1–4,9–13] The present study too reported male predominance with 78 patients (88.6%), which is probably due to more outdoor involvement of males, and the most common causative factor for maxillofacial trauma was noted as RTA in 64 patients (72.7%), followed by fall fracture in 18 patients (18.2%), which is in accordance with various other available literatures.[1,3–5,10,11] However, Jamal BT et al.[2] found assault 56% as the main cause of ophthalmic injuries in patients with ZMC fractures in their study. The present study revealed the peak incidence for maxillofacial trauma in 16–25 years age group. Many surveys of maxillofacial trauma reported similar results concerning age.[4,9–11]

The ZMC fractures are the most commonly associated fractures with ocular involvement.[1] The present study reported the higher involvement of ocular injury with ZMC fracture. This is in agreement with several other studies.[1,2,10–13] Jelks et al.[13] observed the majority of intraocular injury with a 14–40% incidence found associated with zygomatic fractures involving the orbital floor. Moreover Rajkumar GC et al.[1] and Septa D et al.[10] observed the ZMC fractures at 67.2% and 61% as the most frequent fracture associated with orbital involvement in their study, respectively. Zygomatic bone with its more prominent shape makes it more susceptible to fracture, even mild to moderate displacement of the bone can lead to esthetic and functional impairment.

Additionally, Malik AH et al.[3] also observed impaired visual acuity in 13.4% of the patients, while Al-Qurainy et al.[5] and Amrith et al.[12] reported this in around 15.4% and 12.4% of the cases in their study.

Table 5: Distribution of subjects according to type of fracture and ocular injuries

Type of fracture	*Periorbital edema and ecchymosis*		*Subconjunctival hemorrhage*		*Enophthalmos*		*Chemosis*		*Telecanthus*		*Infra orbital nerve paresthesia*		*Transient diplopia*		*Lid Laceration/ soft tissue injury periorbital region*		*Optic nerve damage*	
	Absent	*Present*	*Absent*	*Present*	*Absent*	*Present*	*Absent*	*Present*	*Absent*	*Present*	*Absent*	*Present*	*Absent*	*Present*	*Absent*	*Present*	*Absent*	*Present*
ZMC	2	13	1	14	14	1	13	2	15	0	12	3	15	0	10	5	15	0
Le Fort 1	0	2	0	2	2	0	2	0	2	0	2	0	2	0	1	1	2	0
Le Fort 2	0	2	0	2	2	0	2	0	2	0	0	2	2	0	1	1	2	0
Angle/Body	8	0	8	0	8	0	8	0	8	0	8	0	8	0	8	0	8	0
Condylar/ Subcondylar	12	0	12	0	12	0	12	0	12	0	12	0	12	0	11	1	12	0
Symphysis/ Parasymphysis/ Ramus	22	3	23	2	25	0	25	0	25	0	25	0	25	0	23	2	25	0
Soft tissue injury	15	6	17	4	21	0	21	0	21	0	21	0	21	0	15	6	21	0
Dentoalveolar/ Panfacial	1	2	1	2	2	1	3	0	2	1	1	2	2	1	1	2	2	1
Total	60	28	62	26	86	2	86	2	87	1	81	7	87	1	70	18	87	1

Blindness is a rare and very serious complication of facial injury with an account of 2–5%.[3,14,15] It is mainly due to the injury of the optic nerve itself or retrobulbar hemorrhage and raised intraocular pressure which in turn results in atrophy of the optic nerve. Retrobulbar hemorrhage leads to blindness in midfacial trauma with a range of 10–50%.[2] Optic nerve compression from displaced bone leads to immediate blindness while delayed progressive blindness indicates the compression to the nerve due to hemorrhage/interstitial edema.[1] The present study also reported one case with such injury.

Telecanthus is an increase in the inter-canthal distance due to trauma and it indicates the disruption of anterior and posterior limbs of the ligament. Direct injury to the eyelids or bruising leads to the typical "black eye." No active intervention is required for this; although, follow-up is needed to exclude any associated injury to the eyeball. Conjunctival edema or chemosis may develop due to nonpenetrating which usually resolves with time.[1] The present study noticed only one case of telecanthus and two cases of chemosis. Restricted movement of eyeball that can be due to mechanical entrapment or paralysis of the muscle involved is usually evaluated by extraocular movements. Computed tomography scan and forced duction test are also important for its diagnosis.[1,16,17]

Conclusion

Maxillofacial trauma, particularly midface trauma may affect the integrity of the orbital region resulting in orbital injuries. These injuries can be a laceration, ecchymosis, periorbital edema, or even a globe injury or optic nerve injury that leads to vision loss. Prompt recognition, efficient ophthalmic examination, and proper diagnosis of the ocular injury must be done for each maxillofacial trauma patient in order to provide appropriate management and prevent further ophthalmic complications also.

Clinical Significance

The present study encourages the importance of ophthalmic evaluation in maxillofacial trauma patients and it is also very crucial to make aware or learn the general population about the impact of maxillofacial injury that can lead to major ocular complications.

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