



## Original Article

## Orofacial trauma in rural India: A clinical study

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## ABSTRACT

**Purpose:** Orofacial trauma is becoming a leading medical problem worldwide. Most of the studies pertaining to orofacial trauma have been done in urban areas but very little scientific literature is available for rural areas.

**Methods:** A prospective medical institute-based study of orofacial injury patients was carried out from May 2013 to April 2016 (36 Months). Data regarding incidence, age and sex distribution, causes, types and site of injury, treatment modalities and trauma associated complications were collected and analysed.

**Results:** A total of 784 patients were studied. Males outnumbered females by a ratio of 2.9:1. Age range was 9 months–75 years with the peak incidence in the age-group of 18–34 years. Most injuries were caused by road-side accidents (72.7%), followed by assault and falls in 11.6% and 8% respectively. Soft tissue injuries and mandibular fractures were the most common type of injuries. Head/neck (50.29%) and limb injuries (27.2%) were the most prevalent associated injuries. Surgical debridement and soft tissue suturing was the most common emergency procedure. Closed reduction was performed in 61% of patients and open reduction and internal fixation in 30% of cases and 9% were managed conservatively. Complications occurred in 6.88% of patients, mainly due to infection and malocclusion. The mean duration of hospital stay was (10.12 ± 6.24) days.

**Conclusion:** This study highlights the importance of department of dental surgery along with other disciplines in the management of orofacial injuries. Road-side accident remains the major etiological factor of orofacial injuries in our setting.

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## Introduction

Incidence of trauma is on upward trend all over the world. Orofacial injuries occur in a significant proportion of trauma patients and these are commonly encountered in the practice of emergency department. Orofacial injuries are often associated with high morbidity resulting from increased costs of care. These injuries have remained the topic of interest among researchers owing to varying degrees of physical, functional and cosmetic disfigurement.

Facial trauma is an important health issue because its incidence has repeatedly been shown to be associated with road traffic

accident and assaults. The World Health Organization has estimated that more than 3000 people are killed every day on the road; at least 30,000 others are injured or disabled, so over 1.2 million people are killed and as many as 50 million injured each year.<sup>1</sup> According to an estimate more than 50% of patients with these injuries have multiple trauma requiring coordinated management among various disciplines of anaesthesiology, otolaryngology, trauma surgery, plastic surgery, ophthalmology, and oral and maxillofacial surgery.<sup>2</sup> These injuries can occur as an isolated injury or may be associated with multiple injuries to the head, chest, abdominal, spinal and extremities.

The causes of orofacial injuries vary widely from country to country owing to their specific social, cultural and environmental factors. The causes of orofacial injuries are multifaceted and have changed over the last four decades and they continue to do so. Traffic accident together with assault, falls, occupational trauma and sports injury are deemed to be the most common causes of

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such injuries.<sup>3</sup> The epidemiology of facial injuries varies in injury type, severity and depending upon the population studied.<sup>4</sup> Recent studies from India (Goa,<sup>5</sup> Bhopal,<sup>6</sup> Chennai,<sup>7</sup> Jammu,<sup>8</sup> Gujarat,<sup>9</sup> New Delhi<sup>10</sup>) and from across the globe (China,<sup>11</sup> Italy,<sup>12</sup> South America,<sup>13</sup> South Korea<sup>14</sup>) have shown that road traffic accidents are still the primary causes of facial trauma. The causes and pattern of orofacial injuries reflect trauma patterns within the community and, as such, can provide a guide to plan the programmes catered toward prevention and treatment.<sup>15</sup>

Orofacial injuries involve soft and hard tissue injuries of face extending from frontal bone superiorly to mandible inferiorly and vary from soft tissue lacerations to complex fractures of maxillofacial skeleton. The pattern of these injuries depends on the mechanism of injury, magnitude and direction of impact force and anatomical site.<sup>1,16,17</sup> The management of injuries to the maxillofacial complex remains a challenge for oral and maxillofacial surgeons, demanding both skill and a high level of expertise.<sup>18</sup>

Sonepat district is a part of the Eastern Haryana Plain with estimated population of 1,480,080 and area of 2260 sq km. The district has 328 villages and 6 towns. No elaborative studies have been done so far to find out the aetiological factors and to analyse the extent of various maxillofacial injury patterns in this rural arena. BPS Government Medical College for women, Khanpur kalan, Sonepat is the major maxillofacial trauma centre in the district. So a prospective study was conducted for a period of 36 months from May 2013 to April 2016 to assess the epidemiological characteristics and to describe our own experiences in the management of maxillofacial injuries outlining the incidence, age and sex distribution, causes, types and site of injury, treatment modalities and trauma associated complications of maxillofacial injuries as well as necessity of oral and maxillofacial services associated with multiple injuries of various maxillofacial trauma patients.

The study provides basis for establishment of treatment guideline and planning for preventive strategies.

## Materials and methods

In this prospective medical institute-based study, all consecutive maxillofacial injury patients reporting to the accident & emergency department of the institute from May 2013 to April 2016 were included.

Trauma patients are first seen in the accident & emergency department where resuscitation is carried out according to Advanced Trauma Life Support (ATLS) principles. From the accident & emergency department these patients are admitted in their respective surgical wards or ICU after definitive treatment.

During this study, all orofacial injury patients seen at the accident & emergency department were, consecutively recruited into the study after well informed written consent. Patients who died before initial assessment and those without next of kin to consent were excluded from the study. Ethical approval to conduct the study was obtained from the Institutional Ethic Review Committee before the commencement of the study.

Information relevant to the study was obtained from the patient directly; when this was not possible, collateral history was obtained from either the police or relatives attending to the patients. Data were collected using a pre-tested questionnaire. Data collected included: patient's demographic data, cause of injury, type of injury, time of injury, place of injury, status of prehospital care, mode of arrival in the hospital, associated injuries, severity of injury (Glasgow Coma Scale, GCS), treatment modalities and outcome of treatment (i.e. postoperative complications, length of hospital stay and mortality).

Detailed clinical examination was done and soft tissue lacerations, tooth injuries, number and sites of fractures of maxillofacial

skeleton, and associated injuries were recorded. The diagnosis was based on clinical and radiological findings. In relevant cases CT scan and ultrasonography were done to rule out foreign bodies.

The aetiological factors were divided into traffic accidents, assault and injury associated with fall, the injuries due to variety of causes including sports, occupational and other related injuries (animal bite, gun shot injuries etc). Injuries were grouped as soft tissue injuries, dental injuries, mandibular fractures, zygomatic fractures, orbital fractures, nasal fractures, maxillary fractures, combination fractures (frontal sinus fractures, naso-orbitoethmoid fractures, etc) and multiple injuries.

A detailed survey of these cases with complete data regarding age, gender, type of injuries, emergency management and definite management with different treatment modalities has been collected, reviewed and analysed in detail emphasizing the importance of early management of orofacial injuries to prevent functional as well as aesthetic deformities.

## Results

In the present study, a total number of trauma patients reporting by the accident and emergency department were 784 during 36 months period from May 2013 to April 2016. Patient age at the time of injury ranges from 9 months to 75 years. In most cases, the patient was between 18 and 34 years old. Most of the patients were male (583:201) with the male female ratio of 2.9:1 (Fig. 1).

The vast majority of injuries ( $n = 612$ , 78.06%) were unintentional and the remaining 172 (21.94%) were intentional injuries mainly due to assault and interpersonal violence. There was no history of suicidal or indeterminate intent. The majority of patients (633, 80.74%) sustained blunt injuries and road traffic accident was the most common cause of injuries (570 cases) accounting for 72.7% of all injuries. Of these, 337 (59.1%) injuries were related to motorcycle accidents affecting motorcyclists, passengers and pedestrian.

The most common causes of maxillofacial injuries was traffic accidents involving 570 cases (72.7%) with 438 males and 132 females followed by assault involving 91 cases (11.6%) with 66 males and 25 females and injury associated with fall involving 63 cases (8%) with 39 males and 24 females; the remaining injuries were due to variety of causes including occupational (20 cases with 13 males and 7 females), sports (19 cases with 14 males and 5 females), and miscellaneous (21 cases with 13 males and 8 females) injuries. The data for causes of injuries distributed by gender shows that males of younger age group are more vulnerable.

The majority of patients ( $n = 700$ , 89.3%) arrived to the accident & emergency department and outdoor patient department within

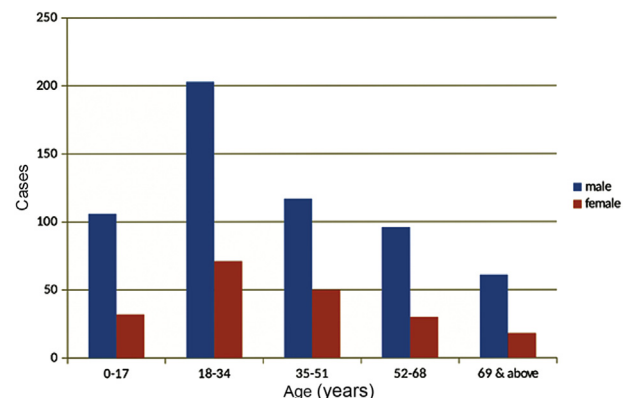


Fig. 1. Age and sex distribution of trauma patients.

24 h. Daytime injuries were recorded in 498 (63.5%) patients while 286 (36.5%) injuries occurred during the night. The majority of the patients, ( $n = 670$ , 85.5%) were brought in by relatives and good wishers. 94 (12%) patients were brought in by police. None of our patients had prehospital care.

Out of the maxillofacial injuries, around 43.9% (344) were soft tissue injuries which included contusion, lacerations, abrasions and burn. The majority of soft tissue injuries ( $n = 286$ , 83.1%) were located extra-orally. 26% (204) were dentoalveolar injuries, 23.1% (181) were fractures and 7% (55) were involved in more than one type of injury.

The highest incidence of maxillofacial trauma was in the age group 18–34 years (274, 34.94%). The major causative factor of maxillofacial trauma was due to road traffic accidents (72.7%) followed by assaults and others (11.6%, Fig. 2).

Of the total 784 trauma patients, 204 patients had dental injuries, of which 128 had lost one or more teeth and 76 patients had restorable injury (tooth fracture, mobility, displacements, etc).

During the study, out of 784 patients, 181 (23.08%) had fractures of maxillofacial skeleton, in whom 149 were males and 32 were females. The male female ratio was 4.7:1. The mandible was commonly involved in 129 (71.27%) patients followed by zygomatico-maxillary complex in 21 (11.60%), nasal in 13 (7.18%), maxilla in 13 (7.18%) and orbital fractures in 5 (2.76%) (Table 1).

The most prominent site of mandibular fracture was parasymphysis (21.70%) followed by angle (16.27%), body (13.95%), symphysis (9.30%), condyle (6.20%), ramus (3.9%) and coronoid (1.5%), and combination fractures involving more than 1 site were present in 27.13% of cases (Fig. 3).

The most prevalent type of mid face fracture was in the zygomatic region (11.60%, Fig. 4).

Out of 784 patients, 338 (43.1%) had associated injuries. Of these, head/neck (50.29%) and extremities (27.2%) regions were commonly affected (Table 2).

In patients who had associated head injuries, 78 patients (61%) had mild head injuries with GCS of 13–15, 31 (24%) had moderate head injuries (GCS: 9–12), and 19 (15%) had severe head injuries (GCS: 3–8).

*Treatment modalities*

Primary management of soft tissue injuries was done with suturing and pressure dressing. Splinting of bony fragments was done in causality department and further definite intervention in mandibular fracture with close or open reduction and follow up were done in outdoor patient department (Fig. 5).

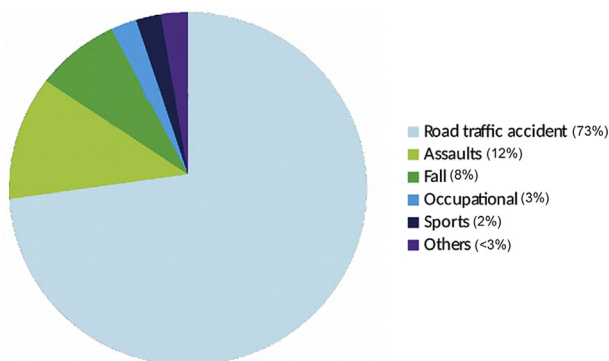


Fig. 2. Aetiological factors causing maxillofacial fractures.

**Table 1**  
Distribution of maxillofacial fractures.

Fracture	Frequency	Percentage (%)
Mandibular fractures	129	71.27
Parasymphysis	28	
Condyle	8	
Angle	21	
Body	18	
Symphysis	12	
Ramus	5	
Coronoid	2	
Combination (>1)	35	
Zygomaticomaxillary complex fractures	21	11.60
Isolated	15	71.42
In combination	6	28.58
Nasal fractures	13	7.18
Isolated	6	33.33
In combination	7	66.66
Maxillary fractures	13	7.18
Le fort I	5	
Le fort II	4	
Le fort III	2	
In combination	2	
Orbital fractures	5	2.76
Isolated	1	20.00
In combination	4	80.00

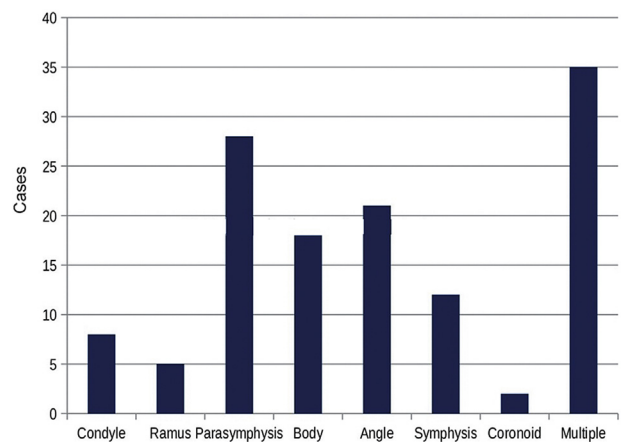


Fig. 3. Site-wise distribution of mandible fracture.

*Mandible fractures*

61% patients (79) were treated with closed reduction and intermaxillary fixation using upper and lower arch bars, 30% (39) with open reduction and rigid fixation using titanium mini plates and 9% (11) by conservative means (Figs. 6 and 7). Fractures of

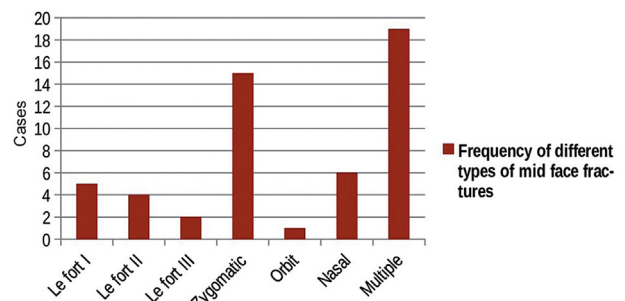
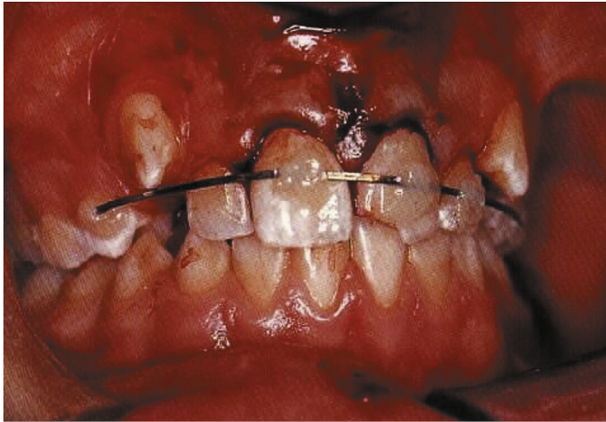


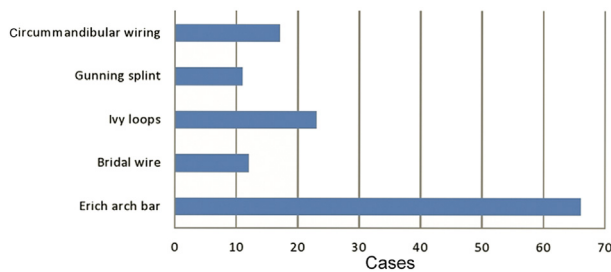
Fig. 4. Site-wise distribution of mid face fracture.

**Table 2**  
Associated injuries (n = 338).

Associated injury	Frequency	Percentage (%)
Head/neck injuries	170	50.29
Thoracic injuries	38	11.24
Abdominal injuries	30	8.87
Extremities injuries	92	27.2
Pelvic injuries	8	2.36

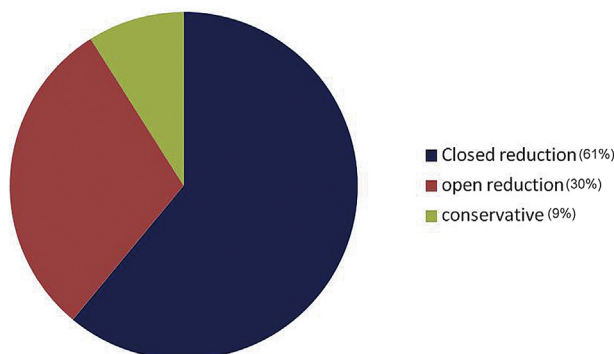


**Fig. 5.** Splinting of mobile teeth.



**Fig. 6.** Bar diagram showing the maxillo-mandibular fixation by different treatment modalities.

edentulous mandible (3.5%) were treated with circum-mandibular wiring and Gunning's splints. In paediatric patients undisplaced jaw fractures (2.3%) were managed conservatively and severely displaced fractures (1.2%) were managed by circummandibular wiring. In some patients (0.7%), resorbable plates were also used (Fig. 8).



**Fig. 7.** Management of mandible fractures.

### Mid-face fractures

Depressed fractures of the zygomatic bone were elevated and reduced with external orbital rim approach and stabilized with direct wiring. Depressed zygomatic arch fractures were elevated and reduced via an intraoral (Keen's) approach. Maxillary fractures (Le Fort type fractures) were treated by circumzygomatic and fronto-zygomatic suspension using arch bars or acrylic splints and dentures. True dentoalveolar fractures and cases of displaced or avulsed teeth were repositioned or re-implanted and the fragments were reduced with ligature wires or arch bars. Naso-frontal fractures were treated with open reduction and transosseous wiring or using titanium mini plates where indicated. Nasal complex fractures were treated with closed reduction and supported by plaster of paris splints and nasal packing.

### Complications

A total of 54 (6.88%) complications were recorded. Of these, surgical site infection and malocclusion were the most prevalent complications in 14 (25.92%) and 11 (20.37%) patients (Table 3).

### Hospital stay

The overall length of hospital stay ranged from 1 day to 26 days (mean stay: 10.12 days  $\pm$  6.24 days). Patients with multiple maxillofacial fractures, associated injuries, maxillofacial burn and those with associated lower limb fractures had significantly longer hospital stay.

### Antibiotic regimen

We used a standard regimen of parenteral antibiotics beginning at the time of admission usually it was amoxycillin (500 mg), cefotaxime (1 g) and metronidazole (500 mg) administered intravenously followed by the same antibiotics administered orally after 48 h or at the time of discharge. In some patients who reported late because of some reasons with post-traumatic residual deformities and complications were also managed accordingly.

### Discussion

Orofacial injuries though rarely fatal, are responsible for functional and cosmetic deformities causing physical and psychological distress on the affected. Worldwide discrepancies in the distribution and occurrence of orofacial injuries have been stated to be a result of varying degree of socio-economic, cultural and environmental influences.<sup>1,17,19,20</sup>

Aetiology is an influential factor in the severity of injuries that results from trauma. The comprehensive analysis of papers about the epidemiology of maxillofacial trauma that were published between January 1980 and December 2013 revealed 69 studies, i.e. Africa (n = 9), North America and Brazil (n = 6), Asia (n = 36), Europe (n = 16), and Oceania (n = 2). In all the studies men outnumbered women, the ratio usually being more than 2:1. In American, African, and Asian studies road traffic crashes were the predominant cause. In European studies the aetiology varied, with assaults and road traffic crashes being the most important factors. In Oceania assaults were the most important.<sup>4</sup>

In our study road traffic accidents are the leading cause of orofacial injuries, which is in consonance with many of the published studies from other parts of India<sup>5–10</sup> and abroad.<sup>11–14</sup> In contrary to the results of our study, interpersonal violence was the most common cause of orofacial trauma in studies done in New Zealand,<sup>21</sup> North-eastern Brazil,<sup>22</sup> Thailand,<sup>23</sup> United Kingdom,<sup>24</sup>

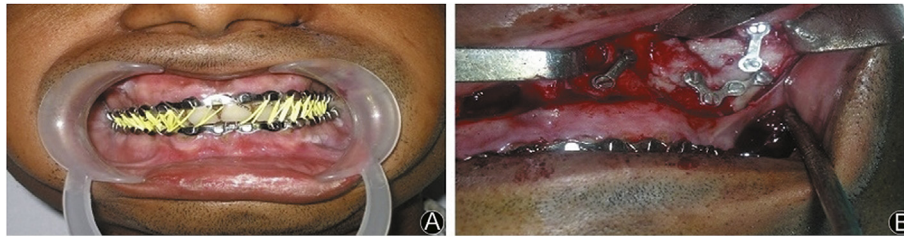


Fig. 8. Stabilization using arch bars (closed reduction, A) & open reduction using titanium mini plates (B).

**Table 3**  
Complications of maxillofacial injuries.

Complications	Frequency	Percentage (%)
Surgical site infection	14	25.92
Malocclusion	11	20.37
Keloids and hypertrophic scar	10	18.51
Chronic sinusitis	9	16.66
Permanent facial deformity	6	11.11
Non-union of fracture	4	7.40

Australia<sup>3</sup> and Zimbabwe.<sup>25</sup> The reasons for this high frequency in Indian scenario are difficult to postulate but may be due to factors such as inadequate road safety awareness, unsuitable road conditions, violation of the speed limit and old vehicles without safety measures such as antibursts locks and energy absorbing materials. Also failure to wear seatbelt or helmets, violation of the traffic rules, use of alcohol or other intoxicating agents, inexperienced young drivers, behavioural disorders and sociocultural insufficiencies of some drivers worsen the picture.

The predominance of orofacial injuries in the younger age group is consistent with the findings of different published work.<sup>2,5–14,17–20</sup> The male predominance in our study agrees with what is reported in the literature.<sup>2,5–14</sup> Males are at greater risk due to their greater participation in high risk activities, which increases their exposure to risk factors such as driving vehicles, sports that involve physical contact, an active social life and drug use, including alcohol.

The pre-hospital care of trauma patient has been reported to be the most important factor in determining the ultimate outcome after maxillofacial injuries.<sup>26,27</sup> None of our patients had pre-hospital care. Similar observations have been reported in previous studies.<sup>2</sup> The lack of advanced pre-hospital care and ineffective ambulance system for transportation of patients to hospitals are a major challenges in providing care for trauma patients in our rural environment and have contributed significantly to the poor outcome of these patients.

Soft tissue injuries were the most frequently occurring type of injury and mandibular fracture was the most frequent type of bony injury. Similar findings were also reported in various studies.<sup>22,28,29</sup>

In our study, Mandible fracture was the most common site of fracture in orofacial region, which is consistent with the findings of other researchers.<sup>5–11,13,14</sup> In contrast Zygoma was the most common site of fracture as per study in Italy.<sup>12</sup> In our study however zygoma was most common site in case of mid-face fractures.

In mandible, the most predominant site was parasymphysis fracture (21.70%), consistent with the findings of other studies.<sup>30–32</sup> But our study was in contrary to the findings of various research studies, which showed body,<sup>33–35</sup> condyle<sup>36</sup> and angle<sup>37</sup> as the most prominent sites of fractures.

The present study illustrated that facial fractures can occur in combination with other injuries, which is corroborated by findings from other studies.<sup>16,35</sup> Hence immediate diagnosis and intelligent

co-operation of general surgical, orthopaedic, plastic, maxillofacial, neurosurgical and ophthalmic and dental teams, is of paramount importance. Head injury accounted for the greater majority of associated injuries and contributed significantly to missed maxillofacial injuries, similar to findings from other studies.<sup>16,38,39</sup>

There are many treatment regimens in maxillofacial fractures, but the treatment chosen may differ depending on many factors like cost of treatment, affordability by the patient, feasibility in the hospital, doctor's decision and skill, patient's willingness to avail the treatment advised, all of which may vary from one country to another. Majority of the patients treated in our hospital were managed by closed reduction with arch bar fixation, which is in simulation with the other studies.<sup>27,32,40,41</sup> Open reduction and internal fixation has been reported to be the gold standard of treatment of maxillofacial fractures. However, this form of treatment needs expertise (i.e. maxillofacial surgeons) and facilities for open reduction and internal fixation which are not readily available.

The average hospital stay in our study (10.12 days) was found to be shorter than that reported by other studies.<sup>37</sup>

In our experience we had to wait for some time to manage orofacial injuries in patients with multiple organ injuries as these patients were shifted to our department after the management by other disciplinarians, with residual deformities, leading to functional as well as aesthetic morbidity.

From our results, it is evident that road traffic accidents was the major etiological factor of orofacial injuries in our setting and the young adult males were the main victims indicating towards the need to improve road safety measures among youths. Prohibition of driving under influence of alcohol, over-speeding, regular use of seat belts and helmet and following traffic legislations are absolutely necessary. Our study also highlights the importance of dental surgery unit along with other disciplinarians for the emergency management of trauma victims.

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