



## Facial and Dental Trauma among Accident Victims (Epidemiology, Diagnosis and Treatment)

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### ABSTRACT

Dental and facial injuries may happen in many motorcycle accidents. In most cases, the injured person is referred to a doctor immediately to assess the possible wound. Therefore, control and management of the damaged teeth and preserving them is necessary to protect the damaged teeth. This study aims to investigate the maxillofacial trauma by survey the victim of motorcycle accidents which are visited by Shahid Beheshti University of Medical Sciences. Therefore, 330 patients in six months of 2015 were studied to gather information. Moreover, most cited manuscripts have been reviewed in detail to obtain treatment proposal procedure for this injured. The result shows that the most frequent incident is a man motorcycle driver in midnight with 88 percent frequency in contrast 12 female. 52 of patients had license but 87 percent did not use helmet at all. 51 percent of patients had dental trauma and others just had facial problems. In this study, most of maxillofacial injuries are related to complicated crown root fracture with 17 percent frequency, and after that the luxation was the second frequent injury with 16.4 percent. Finally, based on the result, some research topics are proposed which could be useful to researchers.

**Key words:** Epidemiology; maxillofacial trauma; motorcycle accidents.

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### INTRODUCTION

In recent years, epidemiological research has demonstrated that accidents do not occur randomly so that there are factors leading to higher risk of such events. Therefore, experts of injury prevention prefer the term injury or unintentional injury over accident [1]. Findings by the Traffic Police indicate that inadequate forward attention, following other cars at dangerously close distances, and inobservance of right of way are the major causes of traffic accidents in Iran. Also, several important causes of motorcycle-related accidents are perhaps incorrect handling, speeding, and insufficient attention to surroundings [2]. It has been demonstrated that human factors play a major role in many traffic incidents. By way of example, in several studies, human factors were probable causes in about 93% of accidents with factors including improper lookout, excessive speed, inattention, and

improper evasive action [3 - 4]. Thus, human factors have a significant part in road injuries and fatalities. The term accident marginalizes the role of human beings and implies that human endeavors are ineffectual in preventing unwanted incidents. However, unanticipated traffic injuries cannot be dismissed as random and unpredictable; they occur when a vulnerable person meets an injurious agent in a hazardous or compromised environment [5]. World Health Organization expresses that over 1.2 million people die in road accidents every year and about 50 million are injured globally. Also, over 90 percent of these fatalities occur in countries with low- and middle-income families, which have only 48 percent of the world's registered vehicles. Moreover, 46 percent of road traffic fatalities pertain to vulnerable road users including pedestrians, cyclists, and motorists and their passengers [6]. Among them over the age of 40 years, especially the male population, traumatic maxillofacial injury is the leading cause of not only disability and morbidity but mortality as well [7 - 8].

Further research indicates that beside pedestrians, the most vulnerable users of traffic networks may very well be motorcyclists, though as indicated, other cyclists and motorists are not immune to this type of injury [6 – 9]. Michael Ray [10] study the treatment of maxillofacial trauma in austere conditions. This research describes some of the challenges and unique considerations a surgeon and their team encounter in treating these injuries in austere conditions. Studies have established that pedestrian motor vehicle accidents may be the most common cause of serious pediatric head injury [5]. The reason these groups are at risk to such extent is that they lack sufficient physical protection [11]. Injuries that involve high levels of force to the head, such as high speed crashes, may result in a separation of the medulla from the pons two components of the brainstem almost always leading to instant fatalities [12]. Seeing that unfortunately young drivers and riders do not in many cases observe speed limits measures must be taken to protect them in other ways [13].

The Ministry of Health has cited research performed in various universities in Iran demonstrating that 51% of traffic incidents leading to fatalities or hospitalization pertain to motorcyclists whereas only 25% of such incidents involve motor cars. This holds true despite the strict laws recently imposed in Iran regarding motorcycle helmet usage and motorcycle riding in general. The former includes loss of tooth, retrograde amnesia, and changes in mental state while the latter consists of various neurological, physical, cognitive, psychosocial, and emotional effects. Motorcyclists undeniably not only lack sufficient physical protection but are possessed of poor conspicuity due to their small size and are also subject to excessive risk taking [2]. According to traffic laws in Iran, violations such as driving or riding on the sidewalk, carrying unconventional loads, illegal towage, driving in the wrong direction or in restricted lanes, and having loud exhaust pipe sounds will result in confiscation of the respective vehicle for a one-week period for the first violation and for a one-month period for subsequent violations. Moreover, a 300,000 rial fine is being imposed on unhelmeted motorcycle riders and passengers. This can also be effective in preventing traffic mishaps and related injuries, specifically maxillofacial and brain trauma. Consequently, they present a serious safety hazard. By way of illustration, the injury rate in Great Britain in 2002 for two wheeled motor

vehicles was 556 per 100 million vehicle kilometers as opposed to 50 per 100 million vehicle kilometers for car users [2]. Therefore, any method that can increase their protection may be significant in reducing motorcyclist road injuries.

### Literature Reviews

According to [14] in a study conducted at the National Study Center for Trauma and Emergency medical Systems, the frequency of fatalities related to motorcyclists deceased by 37 percent after enactment of the Maryland mandatory motorcycle helmet law. Studies performed on motorcycle helmet usage have shown that helmeted motorcyclists are less likely to experience maxillofacial and head injuries compared to motorcyclists not using helmets. It is also significantly less likely for helmeted motorcyclists to suffer from TBIs. Similar results have been reported by other studies such as Lee et al [9]; Huang & Preston [2]; World Health Organization [13]; Crandon et al. [15]. A report on the subject exhibited 29 percent to 73 percent lower fatality rates when motorcycle helmets were used [27]. It has been cited that for every 100 motorcycle fatalities, 37 lives may be saved through helmet use [16]. Moreover, it has been shown that some studies reporting no benefits or small benefits for utilization of motorcycle helmets employ erroneous models or methodologies [11].

Ansari [17] investigates the maxillofacial fractures in Hamedan province of Iran as a retrospective study. Totally, 2268 patients with 3107 facial fractures treated were analyzed between 1987 and 2001, retrospectively. The result shows that men with 21-30 years of age sustained the most facial fractures. The ratio of male to female was 4. Most fractures were caused by motor vehicle accidents (60%, 1360 pts), followed by falls (18.9%, 429 pts), and assaults (10%, 227 pts). Isolated mandibular fractures (52.6%, 1194 pts) were most common, followed by isolated mid-facial fractures (29.5%, 669 pts) and alveolar process fractures (15.1%, 342 pts). 70.8% of patients were treated by closed reduction, 17.8% with open procedures and 11.4% using both. Complications resulting directly from trauma occurred in 5.5% of patients.

Zargar et al. [18] present an epidemiology study of facial injuries during a 13 month of trauma registry in Tehran. Their trauma patients who were hospitalized for more than 24 hours and had

sustained injuries within seven days from admission were included in the study. Of the 8000 trauma patients, four hundred (5%) sustained facial injuries. The result shows that male to female ratio was 4.5 so on. Among them, 53.3% were aged 11-30 years. Motorcyclists who wore a helmet sustained facial fractures less often during traffic accident than those patients who did not wear helmet. Soft tissue injury and facial bone fracture comprised 43.3% and 40.8% of facial injuries, respectively. The majority of Soft tissue injuries (79%) were located extra orally. The mandible and nasal bone were the most commonly fractured facial bones.

Seiedmoalemi and Dadkhah [19] present a study of head and face injuries and helmet use and hospitalization costs of motorcycle accidents. Data in this retrospective descriptive-analytical study was collected from 1626 patient how had accidents and were hospitalized in the Alzahra Hospital in 2010. The result how that accidents by motorcycle comprised 31% of all the registered motor vehicle accidents. The frequency of motorcycle accidents was higher in October and among 21-25 year-olds. The mean period of hospitalization was 4.3 days and the mean of hospital costs was about 9,000,000 Rials. The frequency of head and face injuries was 51% among all the injured motorcyclists, with 22% among those wearing a crash helmet and 78% among those not wearing a crash helmet ( $r = 0.267$ ,  $p$  value = 0.009). A total of 35% of motorcyclists reported wearing crash helmets.

Tuckett *et al.* [20] present a review study in maxillofacial trauma field in the emergency department. An electronic database search was conducted in PubMed and Science Direct on articles from 1970 to the present day. The key search terms were Maxillofacial, Trauma, ATLS, Advanced Trauma Life Support, EMST, Early Management of Severe Trauma, Airway, Eye, Ophthalmic and Management. The results show that physicians are becoming increasingly exposed to major maxillofacial injuries. Resuscitative measures can be complex and require prompt decisions especially in gaining a secure airway. A proposed treatment algorithm for maxillofacial trauma patients has been devised by the authors. Cabalag *et al.* [21] investigate epidemiology and management of maxillofacial fractures in an Australian trauma centre. A retrospective records review was performed for 980 patients who were treated for MF fracture(s) from January 2009 to

December 2011. The results show that in total, 803 fractures from 500 patients were treated operatively. Mandibular fractures were most commonly treated surgically as 79.82%. Postoperative complications occurred in 69 of 500 patients treated surgically as 13.8%, most commonly due to infected metalware 3.20%. Multiple fractures were associated with a higher probability of requiring surgery and developing postoperative complications, compared to isolated fractures.

Connor *et al.* [22] report recent advances in the management of oral and maxillofacial trauma. They summarize recently published papers on maxillofacial trauma in 2 widely read journals: the British Journal of Oral and Maxillofacial Surgery (BJOMS) and the International Journal of Oral and Maxillofacial Surgery (IJOMS). The result shows that most of the research in these journals concerned mandibular fractures, particularly those involving the condyle, but epidemiological studies and midfacial fractures were also well represented. Even though the incidence of facial injury is high, it is difficult to collect data particularly when long-term evaluation is required, as rates of compliance and attendance at follow up tend to be low.

Bazargani *et al.* [23] present a review literature of 95 articles about epidemiological patterns of road traffic crashes in Iran from 1996 to 2014. The result show that a large number of severe road traffic crashes RTCs occur due to collision of two or more vehicles and most of the victims are males aged between 30 and 39 years. Moreover, it is observed that male pedestrian, drivers and passengers are more likely to be severely injured in comparison to females. One of the most prevalent causes of death among adults involved in the RTCs were head injuries and the majority of deaths occur prior to hospitalization. Mortality rates for RTCs are higher in summer, especially during midnight among all age groups. The most common individual and environmental risk factors associated with RTCs include lack of attention, getting trapped in the car, listening to music, fatigue and sleepiness, duration and distance and negligence of seatbelt usage while driving.

Rezaei *et al.* [24] present a study in field epidemiology of maxillofacial trauma in a university hospital of Kermanshah, Iran. They record of 1727 patients were reviewed

retrospectively. Data collected included patients' name, sex, age, date of admission, etiology, type of facial injury, associated non-facial trauma and treatment modalities. Their result show that 1096 patients sustained only a soft-tissue injury. 631 patients had skeletal fractures. The significant majority of patients (78%) were male and the others were female (22%). The mean ages of males and females were roughly similar ( $28.7 \pm 12.5$  for males versus  $29.7 \pm 15.4$  for females). Most patients were between 21 and 30 years old. Motor vehicle accident was the major cause of trauma (74.8%) followed by assault (13.2%) and fall (8.3%). Nasal fracture was the most frequent trauma (45.5%), followed by mandibular (29%) and zygomatic (24.9) fracture. Central nervous system was the commonest associated trauma. 72% of mandibular, 87% of maxillary and 84.8% of zygomatic fractures were reduced via open reduction and rigid internal fixation.

Dean et al. [25] ask a critical question is treating oral & maxillofacial trauma profitable? They introduce an analysis of hospital and surgeon reimbursement at an academic medical center. Their data was collected for patients who were seen for primary trauma management by the department of oral and maxillofacial surgery between June 2011 and July 2014. The result show that a total of 169 patients met the inclusion criteria. There was a statistically significant difference in both the percent of costs recouped and the actual profit. The average percent of costs recouped was 230% for the VCUHS, while OMS only recouped 47% of costs. Finally, they concluded that in their medical center, maxillofacial trauma yields a net profit for the hospital and a net loss for the operating surgeon. Reich et al. [26] present a study in title maxillofacial trauma underestimation of cervical spine injury. Their results shows that 94.3% of patient suffered from cranio maxillofacial injuries only, 4.4% from cervical spine injuries only, and 1.3% from both injuries. In this study cohort the most prevalent craniofacial injuries were 44% midfacial and 22.6% skull base fractures. Cervical spine injuries primarily affected the upper cervical spine column 58.2% vs. 41.8%. Only 6% of cases the cervical spine injury was diagnosed coincidentally, and the cervical spine column was under immobilized.

#### MATERIAL AND METHODS

This study is an analytical survey which is included 330 patients of Shahid Beheshti

University of Medical Sciences. The sample was non-fatally injured motorcyclists in Tehran which its injured was related to facial and dental that admitted to the emergency department. The time period for the study was six month of 2015. Moreover, all patient were included in study and hospitalized patients were excluded from the study. A questionnaire including age, sex, helmet use, diver license, blood pressure were filled for each patient by medically trained staff. Also, the variables include damaged teeth type, number of damaged teeth, reason of injury, location of injury, and the time between the trauma and visit, were studied. The results mean, frequency and percentage were expressed. Kruskal Wallis and Mann-Whitney tests were used in SPSS version 16 statistical software to compare dental injuries based on demographic information in significant level 95 percent. Hospital records were individually reviewed to obtain a complete list of injury diagnosis. Radiography and MRI results were used to verify injury diagnoses when available.

#### RESULTS

##### Epidemiology

After six month, finally the statistical population was evolved to 330 patients which have maxillofacial injury totally. All patients were injured during an incident with motorcycle. From the result, drivers constituted 79 percent and passengers 18 percent of cases, and 3 percent had unknown status. The average age of injured in motorcycle incident with a dental trauma was 28 years, and also most of them was men constituted 88 percent. Obviously, most of the patient including 87 percent don't use helmet at all. However, the 13 percent helmet user just use a hat for head protection. Facial injuries were diagnosed in just cases, or 31 percent. Although, 18 percent has maxillofacial injury but just 51 percent in total has dental trauma. Moreover, just 52 percent of motorcycle drivers had motorcycle driver license. But there is not significant difference between facial and dental trauma with and without license. All demographical status of variables are presented in Table (1).

Moreover, the result shows that from 51 percent patient just 618 teeth had a bad injury thereby motorcycle accident.

**Table 1: The Demographic Status of Injured Motorcycle Incident by Sex, Helmet Use, Rider Status and License Driver**

Demographic Variable	Stature	Percentage
Sexuality	Male	88%
	Female	12%
Driver License	Yes	52%
	No	48%
Helmet Usa	Yes	13%
	No	87%
Rider Status	Driver	79%
	Passenger	18%
	Other	3%
Injury Type	Facial	31%
	Dental	51%
	Maxillofacial	18%

**Table 2: The Type of Injury and Epidemiology in Maxillofacial Trauma Patient**

Maxillofacial Trauma	Number	Percentage
Alveolar fracture	18	5.5%
Avulsion	52	15.8%
Complicated crown fracture	56	17.0%
Complicated crown root fracture	15	4.5%
Concussion	16	4.8%
Extrusion	17	5.2%
Infraction	19	5.8%
Intrusion	9	2.7%
Lateral Luxation	17	5.2%
Luxation	54	16.4%
Root fracture	21	6.4%
Subluxation	10	3.0%
Uncomplicated crown fracture	26	7.9%

Usually, the basic reason of injury was motorcycle-car crash with 62 percent frequency, though 29 percent had fall accident and just 9 percent had motorcycle-motorcycle crash. 82 percent of accident has happened in streets and 15 percent in alley and 3 percent unknown. Also, all patient before one month after accident had a visit by doctor though 83 had it in the very day.

In this study, as is shown in Table (2), most of maxillofacial injuries are related to Complicated crown root fracture with 17 percent frequency, after that the Luxation was the second frequent injury with 16.4 percent. It is important that be notice, most patient are encountered to Avulsion with 15.8 percent frequency after Luxation and Complicated crown root fracture. In addition, rarely patient encountered to Intrusion with 2.7 percent frequency and also Subluxation with 3 percent frequency.

#### **Diagnosis and Complications Trauma**

One of the complications of trauma is bleeding. The bleeding may be due to a simple trauma such as beating, falling down, motorcycle accident or tearing and perforation of organs which is caused by a knife or bullet. Each of the organs of the body including the brain and bones may be damaged or

bleeding. In some cases, bleeding is not easily visible. Bleeding of internal organs such as the liver, kidney and spleen could be transferred into the abdominal cavity. The only sign of this type of bleeding, sometimes is reduction of intravenous blood volume. Bleeding from the mouth, nose and ears may be a sign of internal bleeding although it is not very reliable. If after an accident and severe bleeding, the injured not be immediately treated, he might have the real risk of death. Therefore, major bleeding control must be preceded by all modes to preserve the heart and lungs damages. If there is something such as bullet or stab in the wound, or the wound is caused by bone fractures, in most cases the object should never be removed from the wound. It is recommended to avoid direct pressure to open fractures or any object on the wound. Initially the wound would be bandaged and then it will be fixed with sufficient strength. Sometimes by lifting the bleeding limbs, the blood reduces and overall blood pressure rises. In order to increase brain blood flow and to prevent shock, it is better place the head along the body or lower than it. Since the blood or other secretions of impaired person may be contaminated with infectious agents such as HIV viruses, the nurse should prevent contact with the blood of injured person. Using tourniquet is not recommended to

stop bleeding, but in case of using, it should be visible and letters should be written on the forehead of the patient. Since there is always the risk of cutting and bleeding by the method of direct pressure to the wound, the use of a tourniquet should be reduced to a minimum

### **Treatment and Medical Action to Maxillofacial Trauma**

Most dental injuries which menace motorcyclists will occur during an accident in the anterior region of mouth and upper maxillary. Tooth structure includes hard tissues of the enamel, dentin, cementum a tissue at the center which is called dental pulp. Teeth, surrounded by periodontal fibers are connected to the surrounding bone. Damage can be related to one or more of these structures. Dental trauma could be classified on this basis. These injuries may be variable from a crack in the enamel of the tooth to getting out of their holes. All dental injuries require proper evaluation, medical interventions, periods of clinical and radiographic examination for many years. In case of delay in taking necessary actions after trauma, tooth prognosis will reduce and even in some cases, despite subsequent efforts, there will be no choice but to extraction. One of the most urgent dental trauma is the removal of the tooth from its cavity which mostly happens during an accident. This situation needs fast and correct treatment. Immediate action includes rapid return of teeth to its holes to prevent further damage to the periodontal fibers. In case there was doubt about the correct insertion of teeth, urgent action involves placing implants in a suitable environment. This environment for tooth transfer is HBSS Via span Solution Salt Balanced Hanks which has a high capacity to sustain the life of periodontal fibers for a long period. Other proposed solutions include milk, saliva, physiological saline and water. The next step is early referral to the nearest dentist to action treatment that could improve tooth prognosis.

### **CONCLUSION**

Without doubt, there is continuous need to develop and execute new measures for reduction of trauma incident injuries. Traumatic maxillofacial injuries are of particular concern due to the high fatality, disability, and morbidity rates associated with them. Further research is necessary for development of new techniques for reduction of traffic incidents as well as cares their

victim. One important area of research includes feasibility studies for centralized systems for accident patient and injury type data which also show possible benefits of such systems in planning for safer traffic. For the most part, measures taken in Tehran to reduce traffic fatalities, specifically traumatic maxillofacial injuries, include legislation of stricter traffic laws for all motorists and for motorcyclists in particular, rigorous enforcement of traffic laws by the Tehran Traffic Police, conduction of tutorials on traffic safety and driving laws for traffic law violators, conduction of workshops for the public in order to elevate public awareness regarding traffic affairs, decommission of obsolete vehicles, and supply of free motorcycle helmets in compliance with current standards to motorcyclists.

All those who have suffered trauma should be completely and accurately examined. This examination should be divided into primary and secondary levels. The first evaluation is assessment to establish airway, breathing and blood circulation of injured person. At later stage, during the control pulse the efforts should concentrated on controlling the bleeding and evaluation of tissue perfusion with an emphasis on refilling of the capillary vessels. In addition state of consciousness of injured will be examined using GCS or AVPU chart. In all cases, especially in small bleeding, the patient's clothing will be taken off, secondary assessment will carry out and then, head to toe of injured person will be examined carefully for diagnosed the other injuries.

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