

# The Pattern of Maxillofacial Trauma & its Management

Syed Amjad Shah<sup>1\*</sup>, Zahid Qayyum Bangash<sup>2</sup>, Tahir Ullah Khan<sup>3</sup>, Muhammad Yunas<sup>4</sup>,  
Muhammad Raza<sup>5</sup>, Syed Fahim Shah<sup>6</sup>

<sup>1</sup>Vice Principal, Professor & Head Department of Oral and Maxillofacial Surgery, Riphia International University, Pakistan.

<sup>2</sup>Assistant Professor Oral and Maxillofacial Surgery Margalla College of Dentistry Rawalpindi, University of Health Sciences, Pakistan.

<sup>3</sup>Assistant Professor Oral and Maxillofacial Surgery Peshawar Dental College, Riphia International University, Pakistan.

<sup>4</sup>Assistant Professor Oral Medicine Peshawar Dental College, Riphia International University, Pakistan.

<sup>5</sup>Assistant Professor Prosthodontics, Peshawar Dental College, Riphia International University, Pakistan.

<sup>6</sup>Associate Professor Medicine Institute of Medical Sciences Kohat, Khyber Medical University Pakistan.

Received: September 09, 2016; Accepted: October 05, 2016; Published: November 22, 2016

\*Corresponding author: Amjad Shah Syed, Vice Principal, Head Department Of Oral And Maxillofacial Surgery, Peshawar Dental College Warsak Road Peshawar, Riphia International University, Pakistan. Tel: +923339107122; E-Mail: Amjadshahsyed@Gmail.Com

## Abstract

**Purpose:** The descriptive study was undertaken to determine the pattern and different methods of treatment of maxillofacial fractures.

**Materials and Methods:** Three hundred and twenty consecutive patients with maxillofacial trauma were treated in a tertiary care hospital in last three years. A review of patients' records and radiographs was conducted. Data regarding age, gender, cause of fracture, anatomic site and treatment modalities were reviewed.

**Results:** The age range was 2-76 years (25±8) with peak frequency occurring in age group 21-30 years. The male to female ratio was 5.4:1. The study indicated that (n=206; 64.7%) resulted from road traffic accidents (rtas) followed by fall (n=60; 18.8%), assault (n=26; 8.1%), sports (n=17; 5.3%), firearm injury [FAI (n=3; 0.9%)], industrial trauma (n=2; 0.6%) while 5cases (1.65%) were associated with other causes such as bomb blast, animal injury etc.

The mandible was the most commonly involved (69.7%) followed by zygomatic complex [ZC (8.4%)], maxilla (5.3%), nasal bone (1.3%) and nasoethmoidal fractures (0.9%); in 14.4% of cases, more than one facial bone fracture occurred. Of mandibular fractures, body (30.3%) was the most common site followed by condylar region (24.2%). In midface fractures the ZC was the most susceptible area (48.2% of midface); of maxillary fractures, Le Fort I was the most common fracture (34.5%); the frequency of nasal (7.1%) & nasoethmoidal (5.4%) remained low. Most patients with mandibular fractures were treated by closed reduction surgery [eyelet wiring, arch bars with inter maxillary fixation (IMF) & splint fixation], only 18.9% of patients were treated with open reduction surgery (Interosseous & miniplates fixation). The maxillary fractures were mostly treated with suspension wiring while in ZC fractures Gillies' approach (37.9%) was the common method of management.

**Conclusion:** This study reflects trauma patterns within the community and, as such, can provide a guide to the design of programs geared toward prevention and treatment.

**Keywords** Trauma; Facial Fractures;

## Introduction

The face, as most exposed part of the body, is particularly vulnerable to trauma. [1] The main causes worldwide are road traffic accidents, falls, assaults, sports, firearm injuries and industrial trauma. [3, 14, 25] Clearly, the etiology would be expected to influence the degree and type of injury sustained. [4] Data collected from the 1960s and early 1970s have indicated that 20%-60% of all people injured in R.T. As has some degree of maxillofacial injury. [5] A high incidence of maxillofacial injuries due to R.T.As is reported in developing nations, while incidence due to personal violence is more in developed countries. [6] Introduction of compulsory seat belts and drink-drive legislation [7] have significantly reduced both the number and severity of injuries sustained following road traffic accidents by 25%, and the more serious facial injuries reduced in severity by two-third. [8] It is found that falls were the 2<sup>nd</sup> most common cause after assault though it is recognized that many patients who have assaulted reported that their injuries were due to falls. [3,9] The constant improvement in the quality of individual life and growing interest in sporting activities have resulted in an increased use of sport in free time at the amateur level. As a result, sports injuries have steadily increased. [10,11] Maxillofacial trauma due to firearm injuries has been increasing during the past decades, being one of the greatest challenges for oral maxillofacial surgeons. [12] Greater industrial trauma is reported in industrialized cities.

When the maxillofacial region is injured the most common facial fractures involve the mandible followed by the ZC, maxilla, and alveolar process [14]. Some authors have reported zygoma as a more susceptible bone than the maxilla. [13] The fracture may involve a combination of two or more facial bones. The most favorable sites of fractures (in descending order) in the mandible are the parasymphysis, body, angle, condole region, symphysis, and coronoid process [15].

Age and sex have been cited as important factors that influence the occurrence of maxillofacial injuries. The highest incidence is seen in the age group 20-40 years. The lowest incidence is observed in the age group above 60 years and below 5 years. Most of the patients are male with a male: female ratio of approximately 3:1. [16]

Over the past 100 years, Major developments have been made in the care of victims of maxillofacial trauma such as external skeletal fixation, open reduction, craniofacial exposure, internal wire fixation, primary bone grafting, miniplates and orbital reconstruction. Therefore, such injuries adversely affect the quality of life less frequently today than once did, due to the advances that have been made by countless individuals from diverse disciplinary backgrounds. Collectively, these advances have provided great improvement in the primary and secondary correction of traumatic maxillofacial deformities.

The study was carried out to determine the pattern of oral and maxillofacial trauma and to describe different trends in the management of maxillofacial fractures. This study may provide circumstantial evidence for the recommendation of possible preventive measures. For example, the introduction of seat belt legislation in developed countries, as expected led to a drop in the incidence of maxillofacial injuries resulting from road traffic accidents.

## Material and Methods

The information obtained was based upon analysis of maxillofacial injuries recorded from the department of Oral & maxillofacial Surgery, de' Montmorency college of Dentistry, Lahore during last three years. The descriptive randomized study was conducted on three hundred and twenty consecutive patients as having received maxillofacial injuries. The Sampling technique was non-probability.

### Inclusion criteria

All patients of any age and either sex presenting with maxillofacial trauma to the department were included in the study.

### Exclusion criteria

1. The fractures, which did not need surgical intervention for cosmetic restoration or function improvement
2. Previously maltreated cases.
3. Too old fractures with malunion.
4. Patients having contra-indications for local & general anesthesia.

### Data Collection Procedure

A detailed history of the patient was taken and thorough clinical examination was carried out. Then a specially designed detailed perform (annexure 'a') was filled up. Basic investigations and specific investigations like radiograph such as intra-oral; O. P.g (ortho pantomogram); p.a (postero anterior) mandible; p.n.s

(paranasal sinuses), (10<sup>0</sup> and 30<sup>0</sup>) and submentovertical were carried out to confirm the bony trauma. The fractures were classified according to standard nomenclature. An appropriate management plan was devised and followed up for 6 weeks. The pattern and management of maxillofacial trauma were compiled according to the age, sex, etiology, site, relative frequency and methods of fixation.

On an outpatient basis, simple methods of closed reduction and immobilization were used for mandibular fractures, with patients under local anesthesia. Imf (erich arch bar with elastics) was used for condylar fractures and imf (eyelet wiring) was performed for favorable mandibular fractures.

The patients below 15 years were treated under ga (general anesthesia) because of their uncooperative behavior. The splint fixation was preferred for edentulous patients and for children.

The elevations of zc fractures and circum-zygomatic suspensions for maxillary fractures were performed, with patients under ga.

Open reduction was used in cases of unfavorable fractures atan angle of the mandible and multiple fractures that were difficult to maintain with an arch bar or imf (eyelet wiring), and whenever closed reduction would not maintain the fractured fragments as for example, in severe injuries with significant displacement.

**Data Analysis:** the data so collected were evaluated with chi square ( $\chi^2$ ) test of significance and the results analyzed statistically by applying spss v16 and findings were presented as such.

## Results

### Etiology

During the three years period; 320 patients with different types of maxillofacial fractures were treated. The most common cause of maxillofacial trauma was rtas (n=207; 64.7%), followed by accidental fall (n=60;18.8) and injuries associated with the fight (n=26;8.1%); the remaining fractures were due to a variety of causes, including sports-related injuries in 17 cases (5.3%). The causes of injuries are shown in figure 1. There was no significant difference between the genders regarding etiology (p= 0.110)

### Age and Gender Distribution

The age of the patient at the time of injury ranged from 2-76 years, with a mean age of 25 years  $\pm$  13 years. In most cases, the patient was between the age of 21-30 years (n=105;32.8%). Only 12.8% of patients were less than 11years of age, and 1.3% was more than 60 years of age (figure 3). In virtually all age groups, more men than women were affected, the overall ratio being 5.4:1 (figure 2). P value (0.240) shows no difference between the different age groups regarding causes of injury.

### Sites of Fractures

The most frequent bone fractured was the mandible, which accounted for 223 cases (69.7%), the ZC in 27 cases (8.4%), the

maxilla in 17 cases (5.3%), followed by nasal and nasoethmoidal fractures as shown in figure 4.

14.4% of cases involved combination fractures; of these thirty-four patients (10.6%) sustained fractures of mandible and ZC; 7 patients (2.2%), of the mandible and maxilla; 5 patients (1.6%), of maxilla & ZC (figure 4).

The distribution of the mandibular fractures is detailed in tables 1,2. The most common site was body of the mandible (30.3%), followed by condylar process (24.2%), angle (21.6%), parasymphysis (10.6%), dent alveolar, (5.7%) symphysis (4.9%), ramus (1.9%) and the coronoid process (8%).

The distribution of maxillary fractures (table 1 & 4) was Le Fort in 10 cases (34.5%), Le Fort II in 8 (27.6%), the alveolar process in 7 (24.1%), and Le Fort III in 4 (13.8%) patients. Of zygomatic fractures (tables 1& 6), the zygomatic bone was involved in 57 cases (86.4%) and the arch was fractured in only 9 cases (13.6%). Nasal &nasoethmoidal fractures were found in five and 3 cases respectively as shown in table 1. There were no significant difference between etiology and fracture site (p=0.502).

Distribution of maxillofacial fractures according to etiology

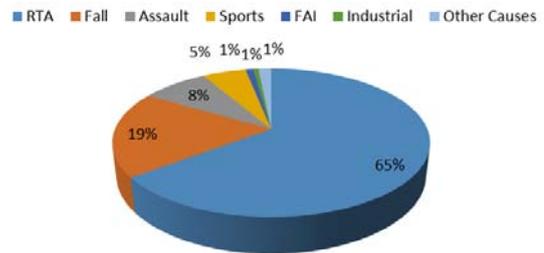


Figure 3

Distribution of maxillofacial fractures according to sex

Male Female

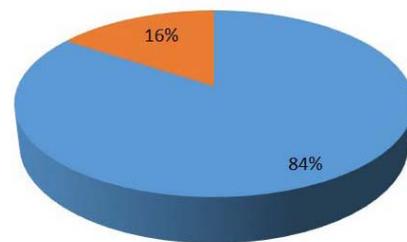


Figure 4

Distribution of maxillofacial fractures according to anatomic site

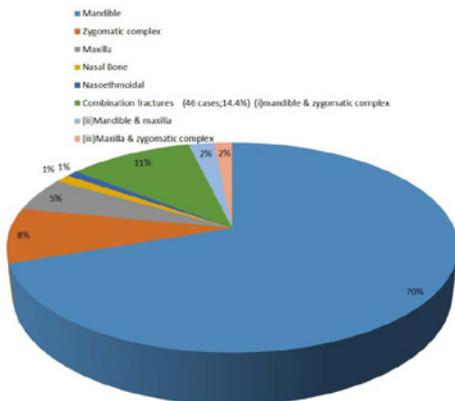


Figure 1

Distribution of maxillofacial fractures according to age

1-10 Years 11-20 Years 21-30 Years 31-40 Years  
41-50 Years 51-60 Years Over 60 Years

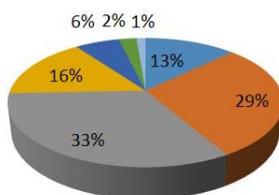


Figure 2

Table 1. Fractures Distribution

	number of cases	percent
Mandibular fracture	223	62.6
Maxillary fracture	17	4.7
zygomatic complex fracture	7	1.9
Midface fracture	56	15.7
Mandibular & Maxillary fracture	7	1.9
Mandibular & Zygomatic fracture	34	9.5
Mandibular+ Maxillary+ Zygomatic fracture	5	1.4
Nasal fracture	4	1.2
Nasoethmoidal	3	0.8
Total	356	100

Treatment

Several methods of reduction and fixation were used in the treatment of mandibular fractures as shown in table 3. Of the 264 mandibular fractures, 214 cases (81%) were treated by closed reduction; 106(40.2%) of these with IMF (eyelet wiring), 65(24.6%) with arch bars and IMF used to treat condylar fractures, 28(10.6%) with splint fixation mostly used for children

and edentulous patients. Only 50 (19%) patients were treated by open reduction and fixation with interosseous wiring and main plates.

Le Fort fractures were treated with circum-zygomatic suspension wiring, interosseous and manipulate fixation (table 5). The most of Le Fort I fractures were managed with wire suspension (31%) whereas in Le Fort II and Le Fort III open reduction with interosseous (24.1%) and miniplate fixation (20.7%) was performed. All such cases were supported by IMF. However, in internal rigid fixation, early removal of IMF was advised. The plain arch bar (half round wire) was used to treat maxillary dent alveolar fractures

Of ZC fractures, 25 cases (37.9%) were reduced through the use of the Gillies' temporal approach whereas 14(21.2%) patients were treated with the transoral approach. The open reduction was performed in 21 cases (31.8%); 18.2% & 13.6% of these were treated with interosseous wiring and miniplate fixation respectively. Only 6 cases (9.1%) were managed conservatively with observation alone as shown in table 7. In Nasal bone fracture, 2 cases were treated with close reduction whereas one fracture with open reduction (table 8). Open reduction was used to treat all the three nasoethmoidal fractures.

### Discussion

The result of epidemiological surveys on the causes and incidence of maxillofacial fractures tend to vary with geographic region, socioeconomic status, culture, religion and era. [14] The predominance of maxillofacial trauma in the age group 21-30 years is consistent with the findings of previously published work. But contrasts with the report of Karyouti, [17] who gave the age group of 0-5 years as having the highest incidence. The possible explanation for the high frequency of the 21-30 year age group is that people in this age group take part in dangerous exercises and sports, drive motor vehicles carelessly, and are most likely to be involved in violence. The lowest frequency was observed in the age group above 60 years (1.3%) contrary to the study of Kapoor and Srivastava [18] in which it was 0-5 years. The limited outdoor activities in old age would be the possible reason.

Most of the studies<sup>3</sup> have shown a higher incidence of maxillofacial fractures in males than females. In this study, it remained 5.4:1 that is higher than reported by Boffano P et al (2.2:1).[14]The higher age of man could be because men are mostly involved in outdoor activities and are also exposed to violent interaction. Male drivers are more as compared to female.

In most previous epidemiological studies traffic accidents were the most common cause of maxillofacial fractures, [3,14,24] and the present study supports these findings. In England, it has been reported that the introduction of the compulsory use of seat belts is having a significant effect with respect to reducing the number of facial injuries.[7] In Pakistan, a law making the use of seat belts compulsory has not been implemented properly. While interviewing the victims of facial trauma due to rtas, it was

Table 2. Distribution of mandibular fractures according to anatomic site.

	number of cases	percent
Body	80	30.3
Condylar	64	24.2
Angle	57	21.6
Parasymphysis	28	10.6
Dentoalveolar	15	5.7
Symphysis	13	4.9
Ramus	5	1.9
Coronoid	2	0.8
Total	264	100

Table 3. Methods of fixation for mandibular fractures.

	number of cases	percent
IMF(eyelet wiring)	106	40.2
IMF(arch bar+elastics)	65	24.6
Splint fixation	28	10.6
Interosseous wiring with IMF	28	10.6
Miniplates fixation with IMF	22	8.3
Plain arch bar	15	5.7
Total	264	100

Table 4. Distribution of maxillary fractures.

	number of cases	percent
Le Fort I	10	34.5
Le Fort II	8	27.6
Maxillary dentoalveolar	7	24.1
Le Fort III	4	13.8
Total	29	100

Table 5. Methods of fixation for maxillary fractures

	number of cases	percent
Suspension wiring with IMF	9	31
Interosseous wiring with IMF	7	24.1
Plane arch bar	7	24.1
Miniplate fixation with IMF	6	20.7
Total	29	100

Table 6. Zygomatic complex fractures(anatomic site).

	number of cases	percent
Zygomatic bone	57	86.4
Zygomatic arch	9	13.6
Total	66	100

observed that the carelessness of many drivers, failure to give the right of way, excessive speed on highways for competition among addict drivers, were responsible for the increase in a number of maxillofacial fractures due to R.T.As.

Islam S et al [9] and Mijiti A [18] reported the assault as the predominant cause of maxillofacial fractures in England and China, respectively. The frequency of 8.1% in this study caused by fighting contrast vividly with their studies, a finding that may be related to differences in social customs alcohol intake. Because of religious background, Pakistanis do not drink alcohol.

When the maxillofacial region is injured, the mandible is more vulnerable than the mid face fractures [14]. This could be because the mandible is mobile and has less bony support than mid facial bones. These fractures are, however, more common in certain sites of the mandible than others. Almost all studies showed that the body of the mandible was the most frequently affected area. The least affected site is the coronoid process [25].

In this study condylar region of the mandible is the 2<sup>nd</sup> most commonly involved site, which is in contrast with figures obtained from studies in Nigeria [1] and Jordan. [3] It is difficult to cite a reason for this difference; perhaps a further study on the causes of the regional mandibular fractures would be useful. One can speculate that inter-population difference in the sites of maxillofacial fractures partly related to the diverse etiologic factors involved. Zhou HH et al [26] observed similar results

Several studies have suggested that mandibular fractures can be treated by closed reduction and I.M.F [19,20]. Olson et al [21] and Hill et al [22] concluded that most mandibular fractures were amenable to management by Closed Reduction. Of the 264 patients in our series, only 50 of mandibular fractures had required open reduction. All methods were used for fixation without the use of any devices for external fixation. Furthermore,

simple methods of Reduction and Immobilization were used on an outpatient basis under local anesthesia. And the results were satisfactory.

In mid face region, the ZC was the most susceptible area. This coincides with the views of Baylan JM et al, [23] who reported that zygoma was the most common site of fractures in the middle 3<sup>rd</sup> of the face. The low frequency of fractures of mid face in our session may be because we lack modern radiological techniques such as C.T scan and loss of patients to other specialties especially nasal fractures are routinely treated by E.N.T surgeons. The simple methods of reduction and fixation were used for mid face and results were satisfactory.

The use of mini plate has become increasingly popular for the management of maxillofacial fractures in recent years [27,28,29]. In this study, 33 cases of mid face were treated with miniplate fixation. The reason for the low frequency of rigid internal fixation is the poor economic conditions of patients [30] and simple methods of the fixation give satisfactory results. However, advantages and effectiveness versus the cost of miniplates fixation need further study in our region.

### Conclusion

The present study revealed that the peak frequency of maxillofacial fractures occurred in the age group consisting of 21-30 years old and most frequent cause was R.T.As (64.7%). The male to female ratio was 5.4:1. The predominant fractured bone was the mandible (69.7%) and the body (30.3% of mandibular fractures) was the most frequent site followed by condylar region (24.2%). In mid face, the zygomatic complex was the most susceptible area (48.2% of mid face). Most fractures were neither severe not complicated and were successively treated by the conventional mean. The most commonly used technique was a closed reduction.

There are obvious limitations to our data, such as the exclusion of cases from related specialties, lack of modern diagnostic methods and poor economic condition of the patients. Despite these limitations, the findings show that there are causes of concern about the high rate of maxillofacial injuries caused by R.T.As, as few people use safety belts, an awareness campaign to educate the public especially drivers about the importance of restraints and protective measures in motor vehicles, should be implemented. These finding should alert the authorities to the need for the enforcement of existing traffic laws to control excessive speed on highways and careless driving; provision of better roads; and the use of safety belts is to be made compulsory.

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**Table 7.** Treatment of zygomatic complex fractures.

	number of cases	percent
Temporal fossa approach	25	37.9
Transoral approach	14	21.2
Open reduction with interosseous wiring	12	18.2
Open reduction with miniplates fixation	9	13.6
Conservative treatment	6	9.1
<b>Total</b>	<b>66</b>	<b>100</b>

**Table 8.** Treatment of nasal fractures.

	number of cases	percent
Closed reduction with tape & plaster	2	50
Closed reduction with manipulation	1	25
Open reduction	1	25
<b>Total</b>	<b>4</b>	<b>100</b>

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