

A CLINICAL STUDY OF THE ORAL AND MAXILLOFACIAL FRACTURE

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• Abstract

With today's social and cultural personal interactions, greater leisure time and participation in sports activities, and growing traffic volume, the risk of physical trauma has increased markedly.

This is a clinical and retrospective study of patients exposed to oral and maxillofacial trauma. We clinically observed 72 patients with trauma in the Department of Oral and Maxillofacial Surgery, Kyunghee University Dental Hospital, from June 2006 through November 2007.

The following data was obtained:

1. The male:female ratio of patients having experienced physical trauma was 6.2:1, with most patients in their twenties.
2. Traffic accident (37.5%) was the most common cause of trauma.
3. The highest incidence of fracture occurred to the zygomatic arch(22.1%) among mid-facial fractures and angle(37.5%), symphysis(35.4%) in mandible fractures.
4. Open reduction (88.9%) was the most frequently used form of treatment. Closed reduction was performed on the remaining 11.1% of cases.
5. Teeth and alveolar bone damage occurred in 23.6% of all cases.
6. Other injuries that were related to mid-face fracture occurred in 27.8% of all cases.
7. Post-operative complications occurred in 31.9% of cases, and the highest complication was the nerve injury.

• Keywords : Oral and maxillofacial trauma, Midface fracture, Mandible fracture

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I. Introduction

Trauma of the facial area may lead to serious emergency situations or result in fatal esthetic and functional disorders. Especially, tooth trauma is accompanied in many cases and dental problems such as occlusal abnormalities and trismus may occur after treatment has been completed. So trauma has been treated as a high frequency disease by oral and maxillofacial surgeons and has been considered one of the exclusive specialties in the field of oral and maxillofacial surgery. But as the field of medicine has become more diversified, other departments are also participating in the treatment of these patients and a large portion of patients are actually getting treatment from medical fields other than oral and maxillofacial surgery. This is especially so in the case of mid-face injuries. This prevents dental students and residents from having as much education and experience in mid-face, orbital, and nasal bone fractures as in the past.

The aim of this study was to understand the situation of high-frequency fractures that actually occur with facial area trauma under the current medical system and suggest the reinforcement of treatment areas of the oral and maxillofacial surgery department. The subjects of this study were 72 oral and maxillofacial trauma patients who had visited the emergency room or outpatient clinic of oral & maxillofacial surgery, East-West Neo Medical Center, Kyunghee University and had been hospitalized during year 2006 to 2007. Factors in the frequency of trauma occurrence include gender, age, trauma area, trauma area according to fracture type and treatment method, accompanying injury(ies), and complications. These were clinically analyzed and compared to prior studies to investigate changes in the frequency of occurrence by trauma type. Many trauma patients injured by traffic and industrial accidents are visiting our hospital emergency room because

of its geographic location and since a department of plastic surgery is not open in our hospital, facial trauma cases are exclusively handled by our department, which allows us relatively accurate analysis of the incidence of maxillofacial trauma.

II. Materials and Methods

1. Subjects

Subjects were 72 patients who had visited the East-West Neo Medical Center, Kyunghee University from June 2006 to November 31st, 2007 through the emergency room and outpatient clinic of oral and maxillofacial surgery and had been hospitalized and treated.

2. Study Method

Factors including gender, age, trauma area, fracture type, etiology, time of injury, hospitalization route, fracture, soft tissue injury, tooth injury classification, treatment method, and complications were reviewed through hospitalization and treatment charts and radiographic records including plain films such as skull series, mandible series, Water's view, Zygomatic arch view, nasal bone view and CT images taken pre- and post-surgery were used as reference. Fracture area among the whole facial area was classified as mandible, maxilla, zygoma, zygomatic arch, nasal bone, etc. according to the method of Schultz¹⁾ and mandibular fracture was classified by the method of Dingman and Natvig²⁾ Maxillary fracture was further classified by the method of Le Fort. Cases such as those with only tooth injury and cases in which the subject deceased before treatment of maxillofacial injury was done were excluded from this study.

Table 1. Distribution according to sex and age

Age	Male	Female	Total
0-9	3	0	3 (4.3%)
10-19	14	0	14 (19.4%)
20-29	16	2	18 (25%)
30-39	7	3	10 (13.9%)
40-49	11	3	14 (19.4%)
Above 50	11	2	13 (18.0%)
Total	62(86.1%)	10(13.9%)	72

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III. Results

1. Gender and Age

The largest portion of patients, 18 (25%) of the total (72) were in their 20s. There were 14 (19.4%) patients (each) in their teens and 40s, with 13 (18% over 50 years of age. Ten patients (13.9%) were in their 30s, and 3 (4.3%) patients

were less than 10 years of age. Most of the patients were in their 20s and except for the group under 10, the remaining age groups showed similar distributions. Out of the total of 72 patients, 62 (86.1%) were male and 10 (13.9%) were female showing a ratio of 6.2:1. (Table 1)

2. Distribution of Etiology

Among the 72 patients, traffic accidents were the cause of trauma for 27 patients (37.5%), followed by violence 12 (16.7%), hurt from a fall 9 (12.5%), with sports and industrial accidents the least likely causes of trauma. (Table 2)

Table 2. Cause of trauma

Cause	No. of Patients
Traffic accident	27(37.5%)
Fall down	9(12.5%)
Violence	12(16.7%)
Exercise	6(8.3%)
Work	4(5.6%)
Unknown	6(8.3%)
etc	8(11.1%)
Total	72

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3. Hospital Admission Route

46 or 63.9% of all patients were hospitalized through the emergency room and 26 (36.1%) patients were hospitalized through other hospitals or the outpatient clinic. (Table 3)

Table 3. Distribution according to the route of admission

Route of admission	No. of patients
Emergency room	46(63.9%)
Clinical	26(36.1%)
Total	72

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4. Distribution of Maxillofacial Fracture Area and Fracture Configuration

Among the 72 patients, there were 125 total fracture sites for an average of 1.7 fracture areas per patient. Mid-face

fracture including the maxilla accounted for 77 cases (61.6%) and mandible fracture in 48 cases (38.4%), confirming that mid-face fractures are more common than mandible fractures.

a) Mid-face fracture

Zygomatic arch fracture was diagnosed in 17 cases (22.1%) among the total of 77 cases of facial bone fracture followed by 12 cases (15.6%) of nasal and blow-out fracture, 11 cases (14.3%) of zygoma fracture, with orbital fracture and Le Fort II fracture seen in 9 cases (11.7%) each. Palatal-Alveolar bone fracture was diagnosed in 6 cases (7.8%). There was only one case (1.2%) of maxillary sinus wall fracture and no cases of Le Fort I, III fracture. (Table 4)

Table 4. Distribution according to fracture site (midfacial fracture)

Fx. site	No. of patient
Zygoma	11(14.3%)
Zygomatic arch	17(22.1%)
nasal bone	12(15.6%)
Le Fort I	0(0%)
Le Fort II	9(11.7%)
Le Fort III	0(0%)
Palatal-Alveolar bone	6(7.8%)
Sinus	1(1.2%)
Orbit	9(11.7%)
Blow-out	12(15.6%)
Total	77

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b) Mandible

Among the 48 cases of mandible fracture, the largest portion consisted of 18 angle fractures (37.5%) and 17 symphysis

Table 5. Distribution according to fracture site (Mandible)

Fx. site	No. of patients	
Symphysis	17(35.4%)	
Condyle	Lt.	2(4.2%)
	Rt.	4(8.3%)
Angle	Both	2(4.2%)
	Lt.	11(22.9%)
Body	Rt.	6(12.5%)
	Both	1(2.1%)
Total	Lt.	2(4.2%)
	Rt.	2(4.2%)
	Both	1(2.1%)
Total	48(100%)	

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fractures (35.4%). Among these, the most commonly seen ones were left angle fractures (11 cases). There were 8 condyle fractures (16.7%), 5 (10.5%) mandible body fractures, but no mandible ramus fractures. (Table 5)

c) Fracture Configuration

More complex fractures (40) were seen than simple fractures. (Table 6)

Table 6. Distribution according to fracture type

Fx.type	No. of patients
Simple	32(44.4%)
Complex	40(55.6%)
Total	72

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5. Distribution of Treatment Method

The patients were roughly classified into the invasive reduction group and non-invasive reduction group. Invasive reduction was conducted in 64 cases (88.9%) and non-invasive reduction in 8 cases (11.1%) and among the invasive treatment group, 26 patients (36.1%) underwent simultaneous non-invasive reduction of other areas. (Table 7)

Table 7. Distribution according to treatment method

Treatment method	No. of patients
OR	38(52.8%)
OR & CR	26(36.1%)
CR	8(11.1%)
Total	72

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Table 8. Distribution according to Intermaxillary Fixation duration

Duration	No. of patients
2 weeks	7(24.1%)
3 weeks	10(34.5%)
4 weeks	3(10.3%)
5 weeks	3(10.3%)
6 weeks	2(6.9%)
7 weeks	2(6.9%)
Above 7 weeks	2(6.9%)
Total	29

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6. Distribution of Intermaxillary Fixation Period

Less than 3 weeks was 34.5%, under 2 weeks 24.1%, and the period showed a tendency to decrease thereafter. More patients did not receive intermaxillary fixation (43 patients) than the number of patients who did. (Table 8)

7. Tooth and Alveolar Bone Injury

Seventeen patients (23.6%) presented with tooth and alveolar bone injury. There were 6 cases (35.3%) each of alveolar bone fracture and tooth crown fracture, 3 cases (17.6%) of avulsion, and one case each of tooth subluxation and root fracture. (Table 9)

Table 9. Tooth and alveolar bone injury

Type of injury	No. of patients
Crown fx.	6(35.3%)
Subluxation	1(5.9%)
Avulsion	3(17.6%)
Alveolar bone fx.	6(35.3%)
Root fx.	1(5.9%)
Total	17

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8. Accompanied Injuries and Complications

Among the 72 patients, 20 patients (27.8%) had injuries to other body parts. The highest incidence of injury was 4 cases involving the temporal bone, and 3 cases each of skin or oral laceration and tibia bone fracture. There were 2 cases of femur injury and other areas such as the clavicle, patella,

Table 10. Distribution of associated injuries

Associated injuries	No. of patients
Finger	2
Temporal bone	4
Femur	2
Skin laceration	3
Clavicle	1
Skull basal	1
Patella	1
Tibia	3
Intraoral laceration	3
Total	20

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and skull base. (Table 10)

Complications were seen in 23 patients with the greatest number (13 patients) complaining of dysesthesia and paresthesia. There were 5 cases of diplopia, 2 cases where the fracture line involved tooth pain, and 1 case each of maxillary sinusitis, TMD, and psychological problems. (Table 11)

Table 11. Postoperative complication

Complication	No. of patients
Numbness	13
Pain of involved tooth	2
Sinusitis	1
Diplopia	5
TMD	1
Mental disorder	1
Total	23

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IV. Discussion

The characteristics of modern society such as the change and acceleration in transportation methods and diversification of social activities are causing an increasing number of emergency situations and assorted forms of trauma. Maxillofacial trauma is affected by the patient's region, socioeconomic status and culture. The incidence of trauma is increasing in modern society due to greater numbers of traffic and industrial accidents, violence, and exercise. Unlike injuries to other areas of the body, maxillofacial injuries may cause serious esthetic and functional complications and occasionally result in life threatening emergency situations.

Not only tooth trauma but also maxillofacial bone fractures are commonly accompanied by maxillofacial injuries and have been considered a high frequency disease by the field of oral and maxillofacial surgery. Many advances have taken place thanks to the development of, among other things, surgical material, but recently the number of patients suffering from multiple facial bone fracture and mid-face fracture that are referred to the department of oral and maxillofacial surgery for treatment has been decreasing. One of the reasons for this is the change of trauma type in modern society. There have been studies of the incidence

and aspects of oral and maxillofacial area trauma from the past in our department and the results show that the aspects are changing with time and this change has been reported to be closely related with social, cultural and economic factors. Recently with the functional restoration of maxillofacial trauma, esthetic recovery is considered to be very important. For this reason many patients are receiving treatment from other medical departments and the number of oral and maxillofacial patients seen by oral and maxillofacial surgeons is decreasing. Especially in the case of mid-face fracture, it is generally being treated in other departments. This is making it difficult for dental students and residents to gain valuable experience with trauma patients.

This study concentrated on comparing the incidence of maxillofacial bone fracture type today with reports of the past to elucidate the type of fracture that occurs with high frequency and which departments treat them. Because of its geographic location, our hospital receives many patients suffering from trauma caused by traffic and industrial accidents, and since a department of plastic surgery does not exist, patients with a chief complaint of maxillofacial trauma are exclusively treated by our department. Because of these factors, it was possible to gain relatively accurate data concerning the type of maxillofacial trauma.

The results of our study show that the male to female ratio is 6.2:1. This is a larger number of male patients compared to previous studies by You³ 5.3:1, Lee⁴ 4.6:1 and Kruger⁵ 3:1. The age distribution reported by Adekeye⁶ and Nakamura⁷ decreased from the 20s, 30s and teens and domestic data by You³ showed that 25% of patients were in their 20s, 21% in their 30s, and 18% in their teens. Lee⁸ reported the incidence of trauma in descending order of frequency to be 20s, 30s, 40s and teens. Our study showed the highest percentage (25%) in their 20s, teens and 40s (19.4%), over fifty (18%), then 30s and below 10, which confirms previous studies that show the highest trauma rate among patients in their 20s. The difference that appears in other age ranges may be caused by regional, social, and/or cultural gaps.

Turvey⁹ and Lee⁸ reported traffic accidents as the main cause while Kruger⁵ and Nakamura⁷ considered violence as the most common etiology. The study of Lee⁴ shows that the ratio of cause changes according to the period and year, and recently the ratio of traffic accidents has been increasing compared to violence. Our study reported the trauma rate due to traffic accidents (37.5%) followed by violence

(16.7%), falls and exercise. It is expected that the percentage of patients suffering trauma from traffic accidents will steadily increase in modern society.

The prevalence of trauma area has been reported by Schultz¹⁾, in descending order of occurrence, to be nasal bone, zygoma and zygomatic arch, mandible and maxilla, while Nakamura⁷⁾ reported (in descending order of occurrence) zygoma and zygomatic arch, nasal bone, mandible and maxilla. Domestic studies by Lee⁸⁾ reported (in descending order of occurrence) zygoma, maxilla, nasal bone, and zygomatic arch and Kim¹²⁾ reported (in descending order of occurrence) zygomatic arch, zygoma, nasal bone, and maxilla. In our study, zygomatic arch fracture (22.1%) was the most common trauma followed by nasal and blow-out fracture (15.6%), then zygoma fracture, which confirms the frequency of fractures in the zygoma area compared to mandible fracture. Mid-face fracture including the maxilla shows a higher prevalence, which confirms the findings of other studies.

Concerning the area of mandible fracture, Nakamura⁷⁾ reported mandible body, Kruger⁵⁾ and Kelly¹¹⁾ et al. reported angle area, Dingman³⁾ et al. reported condyle while Lee et al. and Soh et al.¹³⁾ reported symphysis as the most frequent fracture site. Our study showed a slightly lower prevalence of symphysis fracture (35.4%) compared to angle fracture (37.5%), and among angle fracture, left angle fracture was the most common. The variety of fracture areas originates from differences in anatomical structure and impact velocity, impact direction, and the shape of the article of impact. The reason for the higher prevalence of left angle fracture may be violence done by right-handed attackers.

In the case of mid-face fracture, complex fracture occurs most frequently. Adekeye⁶⁾ et al. reported a 14.2% rate and Lee⁸⁾ et al. reported a 25% rate. Our study found that 40 patients (55.6%) among the 72 patients suffered complex fractures, indicating that mid-face fractures are usually in the form of complex fractures. This may result from the multiple impacts to the facial bone that take place in traffic and industrial accidents compared to a single impact from violence or falls.

The treatment of a fracture is roughly differentiated into invasive and non-invasive reduction. Lee⁸⁾ et al. reported invasive reductions in 76.4% patients and the rest (23.6%) received non-invasive reduction. Our study found invasive reduction was performed in 88.9% of patients, which was significantly more frequent than the non-invasive reduction

rate (11.1%). Considering the fact that except for cases of nasal bone fracture or condyle fracture, conservative treatment is excluded and invasive approaches are taken, the high frequency can be explained.

Intermaxillary fixation is a necessary and imperative treatment procedure performed to improve the displaced maxilla-mandible occlusal relationship and gain occlusal stabilization. In our study, the fixation period was less than 3 weeks (34.5%), less than 2 weeks (24.1%), and tended to decrease thereafter. Lee et al. reported a 78.4% fixation rate in patients while in our study, the number of patients that went through fixation were less than the ones who did not. This is because in the case of mid-face fracture, fixation is not conducted when the effect on occlusal relationship is not significant and the fact that mid-face fracture is generally more common than mandible fracture may have caused this result.

In the case of tooth and alveolar bone fracture, Lee⁸⁾ et al. reported that 32.2% of the patients had tooth and alveolar bone fracture but in our study the percentage was lower (23.6%), which reflects the fact that mid-face fracture is more frequent than lower-face fracture in traffic accidents.

Accompanying injuries to other body sites were reported as 28.2% by Jang et al.¹⁴⁾ and as high as 66.3% by Lee⁸⁾ et al.. Our results were 27.8%, which is similar to Jang et al. Serious skull injuries were frequently associated with mid-face and mandible fracture.

Lee⁸⁾ et al. reported that post surgical complications were found in 9%, and in descending order of frequency, malocclusion, visual loss, nerve damage, malunion, and diplopia. In this study, 23 (31.9%) out of the 72 patients had complications. The most common were paresthesia and dysesthesia of the surgical area, which was observed in 13 patients. It was mainly caused by infraorbital nerve damage accompanied by mid-face fracture and inferior alveolar nerve damage accompanied by mandible fracture, but we speculated that the number of cases was actually larger since those with transient pain or discomfort did not report their complaints. Other complications included diplopia (5 cases), fracture line involving tooth pain (2 cases), and 1 case each of maxillary sinusitis, TMD and psychological problems. We can see that complications are more common with maxilla and mid-face fracture than with mandible fracture. It is not commonly seen, but there was an incidence in which the patient complained of symptoms of posttraumatic syndrome including insomnia, chronic pain of the surgical

area, and anxiety and had to be referred to the psychiatric department for further treatment.

The above results tell us that when maxillofacial trauma occurs, mid-face fracture takes place more often than simple fracture of the mandible and the main cause is traffic accidents which is a condition that does not differ largely from the past. So the fact that a large portion of trauma patients is being referred to other medical fields may be the reason why the number of maxillofacial trauma patients treated in the department of oral and maxillofacial surgery is decreasing.

Recently as the distinction between different parts of medicine becomes blurred, expansion of each field is taking place. There is also a motion to expand the field of oral and maxillofacial surgery through esthetic surgery. But we should not forget that it is also important to reinforce our specialty field; so it is very important for the development of oral and maxillofacial surgery to secure and develop treatment for diseases that have been frequently handled previously such as trauma. In modern society as involvement in leisure activities and sports increases, sports medicine is gaining the spotlight and sports dentistry is also being introduced to the field of dentistry. We should actively get involved in this movement to propagate the prevention and treatment of maxillofacial trauma. Efforts should also be made to enhance public recognition that maxillofacial trauma should be treated by an oral and maxillofacial surgeon. Frequent advertising in mass media of the benefits of wearing seatbelts and safety garments such as helmets and mouth guards to prevent additional trauma, specifically in traffic accidents which are the main cause of maxillofacial trauma, and the importance of correct treatment procedures are another means of spreading the word about maxillofacial trauma.

V. Conclusion

The authors analyzed data of 72 patients who visited the

East-West Neo Medical Center, Kyunghee University from June 2006 to November 31st, 2007, through the emergency room and outpatient clinic of the Oral and Maxillofacial Surgery Department and were hospitalized and treated. The following results have been drawn from these clinical statistical studies.

1. The male to female ratio was 6.2:1 showing a preference for the male gender. The largest portion of patients were in their 20s (25%) and patients in their teens and 40s were 19.4% each, over 50 were 18%, 30s and below 10 were next.
2. The cause was, in descending order, traffic accident (37.5%), violence (16.7%), fall (12.5%), exercise and industrial accident.
3. The route of admission was mostly through the emergency room 63.9% and through other hospitals or the outpatient clinic 36.1%.
4. The area of fracture was mid-face 61.6% and mandible 38.4% showing that mid-face fracture is more common. Among the mid-face bone fracture, zygomatic arch fracture (22.1%) was the most prevalent followed by nasal and blow-out fracture (15.6%), and zygoma fracture. Among mandible fractures, symphysis fracture (35.4%), angle fracture (37.5%) were the most prevalent with left angle fracture (11 cases) being the most common mandible fracture.
5. In the case of treatment method, invasive reduction was conducted on 88.9% of injuries, which is larger than the 11.1% of patients who received non-invasive reduction.
6. The period of intermaxillary fixation was generally under 3 weeks and tended to decrease thereafter.
7. The percentage of patients with tooth and alveolar bone fracture was 23.6% among the total patient group.
8. 27.8% of patients with mid-face fracture suffered other accompanying injuries and 31.9% of all patients had complications. The most common complaints were paresthesia and dysesthesia, followed by diplopia, tooth pain of the affected area, temporomandibular disorder, and psychological problems.

References

1. Schultz RC: Facial injuries. 2nd ed. Chicago : Year Book Medical Publishers ; 1977.
2. Dingman RO, Natvig P: Surgery of Facial Fractures. Philadelphia: WB saunders co.; 1973.
3. Ryu SY, Cho KS. A clinicostatistical study on midfacial bone fracture. *J Kor Maxillofac Plast Reconstr Surg.* 1997; 19: 367-376.
4. Lee JH, Kim YD, Shin SH. A comparative study on alterations of facial bone fracture patients visiting Pusan Univ.-hospital emergency center. *J Kor Maxillofac Plast Reconstr Surg.* 2005; 27: 171-176.
5. Kruger GO : Textbook of Oral and Maxillofacial Surgery. 5th ed. St. Louis: Mosby co.; 1979.
6. Adekeye EO. The pattern of fractures of the facial skeleton in Kaduna. *Oral Surg Oral Med Oral Pathol.* 1980; 49: 491-495.
7. Nakamura T, Gross CW. Facial fractures : Analysis of five years of experience. *Arch Otolaryngol.* 1973 ; 97: 288-290.
8. Lee SY, Park KS, Kim TY. A clinical study on the midface fracture. *J Kor Oral Maxillofac Surg.* 2000; 26: 399-406.
9. Turvey TA. Midfacial fractures : A retrospective analysis of 593 cases. *Oral Surg Oral Med Oral Pathol.* 1977; 35: 887-891.
10. Rowe NL, Williams JLI : Maxillofacial injuries. New York: Churchill Livingstone; 1985.
11. Kelly DE. A survey of facial fractures : Bellevue hospital 1948-1974. *J Oral Surg.* 1975; 33: 146.
12. Kim SG, Yeo HH, Kim YK. Clinical study of midface fracture. *J Kor Maxillofac Plast Reconstr Surg.* 1995; 17: 163-170.
13. Soh BS, Ahn TS, Yun CH. A clinical study of the appearance and degree of the facial injuries. *J Kor Maxillofac Plast Reconstr Surg.* 1995; 17: 264-275.
14. Jang HS, Jang MJ. Clinical study of maxillofacial fracture. *J Kor Maxillofac Plast Reconstr Surg.* 1996; 18: 454-462.