

Demographic Analysis, Diagnosis, and Treatment Methods of Maxillofacial Trauma Cases in the Southeastern Anatolia Region of Turkey: Retrospective and Comparative Analysis

Türkiye'nin Güneydoğu Anadolu Bölgesindeki Maksillofasiyal Travma Olgularının Demografik Analizi, Tanı ve Tedavi Yöntemleri: Retrospektif ve Karşılaştırmalı Analiz

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ABSTRACT

Objective: The aim of this study was to make a retrospective analysis of cases treated with a diagnosis of maxillofacial fracture in southeast Turkey and to compare the frequency and etiology of maxillofacial fractures and evaluate them in the light of current literature.

Methods: Distribution of maxillofacial fractures according to etiology, gender and age, fracture localization, distribution of isolated mandible fractures according to mandible parts, treatment methods, and anesthesia type were evaluated in clinical records.

Results: A total of 488 patients diagnosed with maxillofacial fracture were included in the study. Of these patients, 74% are male and 26% are female. Regardless of age and gender, the most common cause of trauma is motor vehicle accidents with 29.3%. In fractures resulting from maxillofacial traumas, isolated mandible fractures take the first place with 79.1%. Condyle (24%) and angle (23%) fractures are the most common fractures of the mandible. About 75.61% of the patients were treated with closed reduction and 84% were operated under local anesthesia.

Conclusion: The most common etiological cause of maxillofacial fractures is motor vehicle accidents. Most fractures can be treated with closed reduction without complications, but there are cases where open reduction internal fixation methods are also absolutely necessary.

Keywords mandible fractures, maxillofacial fractures, maxillofacial trauma

ÖZ

Amaç: Türkiye'nin güneydoğusunda maksillofasiyal fraktür teşhisiyle tedavileri yapılmış hastaların retrospektif analizlerinin yapılması ve maksillofasiyal kırıkların etiyolojisi ve sıklığını karşılaştırarak güncel literatürler ışığında değerlendirmektir.

Yöntem: Maksillofasiyal fraktürlerin yaş ve cinsiyete göre dağılımları, etiyolojisi, fraktür lokalizasyonu, izole mandibula fraktürlerinin mandibula bölümlerine göre dağılımları, tedavi yöntemleri ve anestezi türü değerlendirildi.

Bulgular: Maksillofasiyal fraktür tanısı alan 488 hastanın %74'ü erkek %26'sı kadındır. Yaş ve cinsiyetten bağımsız olarak en sık travma nedeni %29.3 ile motorlu taşıt kazalarıdır. Maksillofasiyal travmalarda dağılım yönünden ilk sırayı %79.1 ile izole mandibula fraktürleri almaktadır. Mandibula fraktürleri arasında en sık %24 ile kondil, %23 ile angulus kırıkları görülmektedir. Hastaların %75.61'i kapalı redüksiyon ile tedavi edilmiş olup %84'ü lokal anestezi altında opere edilmiştir.

Sonuç: Maksillofasiyal fraktürlerin en sık görülen etiyolojik nedeni motorlu taşıt kazalarıdır. Çoğu fraktür kapalı redüksiyon ile komplikasyonsuz tedavi edilebilir ancak açık redüksiyon ve internal fiksasyon yöntemlerinin de mutlaka gerekli olduğu durumlar vardır.

Anahtar Kelimeler: Maksillofasiyal travma, maksillofasiyal fraktürler, mandibula fraktürleri

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INTRODUCTION

Maxillofacial fractures are common and an important health problem. Maxillofacial fractures develop as a result of traumas and can cause significant functional, aesthetic, phonetic, and even psychological problems when not treated and/or incorrectly treated by causing changes in the profile-facial appearance of the patient. The direction and degree of the incoming force, the size of the surface area of the factor causing the trauma, the anatomy of the area exposed to the trauma, the resistance of

the bone tissues to the force, and the attached muscle attachments in the area where the trauma occurred are the factors that are effective in the formation of maxillofacial fractures.^{1,2} Commonly reported maxillofacial fracture sites include the maxilla, mandible, zygomatic bone, orbita, and nasal bone.³⁻⁶ Mandible fractures constitute a large part of fractures in the maxillofacial region.⁴ Etiologies of maxillofacial traumas vary among societies according to sociocultural structures, environmental, and economic factors.^{4,7} Although the incidence of maxillofacial trauma because of assaults is high in developed countries, it is reported that the most common cause in developing countries is motor vehicle accidents.⁸ Falls, sports injuries, work accidents, and shot gun injuries are other causes.^{4,6} Patients often present with complaints of bleeding, ecchymosis, edema, and pain in the trauma area, and malocclusion is detected in most of the examinations. Although rare, olfactory problems may develop and visual disturbances may be encountered in fractures affecting the orbital bone. In addition, airway obstruction may develop in comminuted multiple fractures.⁹ Diagnosis of maxillofacial fractures is determined by clinical and radiological examination. In addition to direct radiographs in radiological examination, fracture lines can be seen more clearly with 3-dimensional tomographic images, which have recently become widespread. Fractures can be treated with many methods. The treatment method may vary depending on the type of fracture, the relevant region, the systemic condition and age of the patient, the presence of teeth, and the time elapsed from the formation of the fracture to its treatment.⁵

The aim of this research was to compare the frequency and etiology of cases with maxillofacial fractures in southeast Turkey and evaluate them in the light of current literature.

MATERIAL AND METHODS

This study was obtained by a retrospective analysis of the data comprising 488 cases treated with the diagnosis of maxillofacial fracture in the 15-year period between January 2007 and January 2022 in XX University Faculty of Dentistry, Department of Oral and Maxillofacial Surgery. The approval by the XX University Faculty of Dentistry Local Ethics Committee was obtained for this study with the decision numbered 2021-66. The data of patients with maxillofacial fractures were scanned and their gender, age, city, fracture localization, etiology, and treatment methods were analyzed. Children aged between 0 and 12 years and adolescents aged between 12 and 18 years were grouped as "young patients" and those over the age of 18 years were grouped as "adult patients." Maxillofacial bones with fractures were classified, and fractures in the mandibular bone were re-divided into symphysis, parasymphysis, corpus, angulus, ramus, and condyle according to their localization. Etiological causes were classified, and treatment methods (open reduction and closed reduction methods) as well as type of anesthesia applied were evaluated. Averages and percentages were calculated using the Microsoft Excel software.

RESULTS

Age and Gender Distribution

A total of 488 patients diagnosed with maxillofacial fracture were included in the study. The mean age of all cases was 32, with the youngest being 4 years old and the oldest 76 years old. Of these 488 patients, 361 (74%) were male and 127 (26%) were female. The number of young patients was 276 (57%), whereas the number of adult patients was 212 (43%) (Table 1). Of the young patients, 189

Table 1. Gender distribution of patients with maxillofacial fracture

	Young (%)	Adult (%)	Total (%)
Male	189 (68)	172 (81)	361 (74)
Female	87 (32)	40 (19)	127 (26)
Total	276 (100)	212(100)	488 (100)

Table 2. Etiology of maxillofacial traumas

Etiology	n	%
Traffic accidents	143	29.3
Fall/ Impact	129	26.4
Assault	120	24.5
Falling from high	54	11
Animal kick	17	3.4
Work accident	8	1.6
Shot gun injuries	8	1.6
Pathological fracture due to tooth extraction	8	1.6
Spontaneous fracture as a result of osteonecrosis	1	0.2

Table 3. Distribution by fracture localization

Fractured bone	n	%
Isolated mandible fracture	386	79.1
Isolated maxillary fracture	62	12.7
Mand.+Max. fracture	17	3.4
Combined fractures	14	2.9
Infraorbital rim fractures	5	1
Isolated zygoma fracture	4	0.8

(68%) were male and 87 (32%) were female. Most of the adult patients were male (n = 172, 81%) and 40 patients (19%) were female (Table 1). It was observed that 389 (80%) of these patients resided in our province, and 99 (20%) were referred to us from other provinces of the Southeastern Anatolia region.

Etiology

When the etiology was evaluated in maxillofacial traumas regardless of age and gender, it was seen that the most common cause was motor vehicle accidents (29.3%). This was followed by impact or fall (26.4%), assault (24.5%), and other causes (Table 2). Traffic accidents predominated in adult patients, whereas falls were the most common cause of trauma in young patients.

Fracture Localization

In this study, isolated mandible fractures take the first place in terms of distribution in maxillofacial traumas. This is followed by isolated maxillary fractures, combined fractures of the maxilla and mandible, combined fractures involving the midface bones and jaws, infraorbital rim fractures, and isolated zygoma fractures (Table 3).

When mandibular fractures were examined in the study, condyle fractures were in the first place (24%, n:94). Angulus (23%, n:90), parasymphysis (19%, n:74), symphysis (12%, n:44), and corpus (5%, n:20) fractures followed condyle fractures. The least common was ramus fracture with an incidence of 1% (only in 4 cases). Sixty of these patients with isolated mandible fractures had combined fractures (16%) involving different parts of the mandible together (Figure 1).

Treatment Methods and Type of Anesthesia

When the treatment methods were examined, the number of cases treated with only intermaxillary fixation was 369 (75.61%), and the number of cases treated with open reduction and miniplate osteosynthesis was 106. Of these patients, 64 (13.11%) were treated with only miniplate osteosynthesis and 42 (8.61%) were

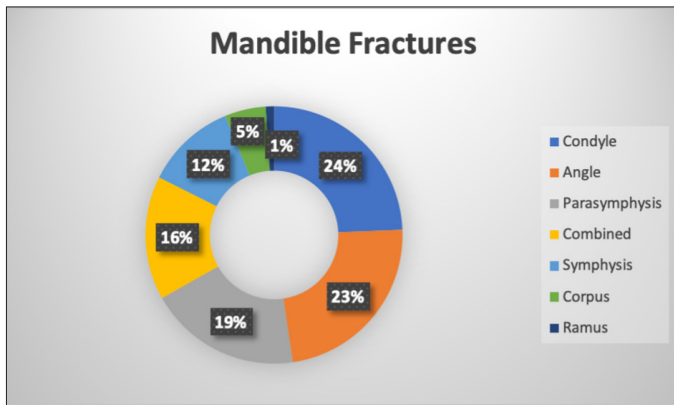


Figure 1.
Distribution of isolated mandible fractures according to mandible parts

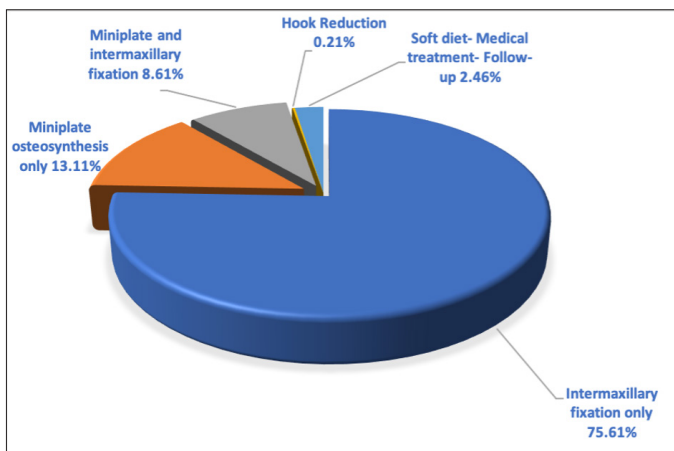


Figure 2.
Distribution of treatment methods

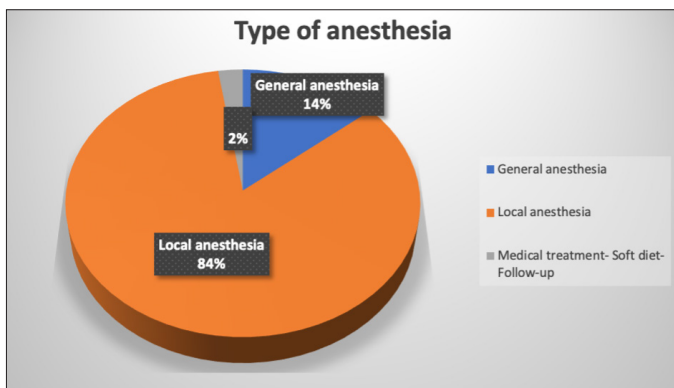


Figure 3.
Distribution by type of anesthesia

Table 4. Distribution of fracture treatments by type of anesthesia

	Isolated Mandible Fracture	Isolated Maxilla Fracture	Maxilla and Mandible Fracture	Combined Fractures	Infraorbital Rim Fractures	Zygoma Fracture
GA	52 (%13,47)	4 (%8)	1 (%5,88)	3 (%21,43)	5 (%100)	3 (%75)
LA	334 (%86,53)	46 (%92)	16 (%94,12)	11 (%78,57)		1 (%25)
Total	386	50	17	14	5	4

GA: General Anesthesia LA: Local Anesthesia

treated with miniplate and intermaxillary fixation. It was determined that hook reduction was performed with closed method under local anesthesia in 1 patient who had zygomatic arch fracture. It was determined that 12 patients without malocclusion, phonetic, and aesthetic problems were followed up with medical treatment and soft diet recommendations (Figure 2). Although 408 (84%) patients with maxillofacial trauma were treated under local anesthesia, 68 (14%) were treated under general anesthesia. In 12 of the cases, medical treatment was provided, a soft diet was recommended, and patients were followed up (Figure 3). The patients who were operated under general anesthesia were treated with open reduction and miniplate osteosynthesis was performed. Of the patients with isolated mandible fractures, 334 were treated under local anesthesia and 52 under general anesthesia. Miniplate osteosynthesis with open reduction was performed in 35 of the patients who were processed under local anesthesia; 299 of these patients were treated with intermaxillary fixation only. Although 46 patients with isolated maxillary fractures were treated with only intermaxillary fixation under local anesthesia, 4 patients were operated on by open reduction under general anesthesia. All of the infraorbital rim fractures were treated under general anesthesia, 3 of the zygoma fractures were reduced under general anesthesia, and 1 under local anesthesia (Table 4).

DISCUSSION

When the patients who developed fractures as a result of maxillofacial trauma were evaluated, it was seen that the number of men is higher.^{4,5,10,11} Our results were also compatible with the literature, and the number of male patients (74%) was higher when gender-based comparison was made. Maxillofacial fractures may develop in any age group.⁵ In some studies, it has been reported that the frequency of maxillofacial fractures in the young patient population is lower than that in the adult population.⁴ Alharbi et al., Kamath et al., and Motamedi et al. reported that the highest incidence of maxillofacial fracture was between the age of 21 and 30 years.^{10,12,13} In addition, in a study conducted in Australia, it was reported that the age ranging from 15 to 24 years was the most affected group.⁶ In our study, 56% of the patients with maxillofacial fractures were young patients (children aged: 0-12 years and adolescents aged: 12-18 years). The reason for this may be the low sociocultural and economic situation in the region and the indifference of the families. The number of men was higher than women in both the young patient group and the adult patient group.

The etiologies of maxillofacial fractures vary according to the ethnicity, cultural status, socioeconomic level, climate, and geographical structure of the region.^{5,7} In addition, in most of the studies, in-vehicle and out-of-vehicle traffic accidents are in the first place as the etiological cause.^{1,5,10} In this study, when the etiology is evaluated regardless of age and gender, traffic accidents come first in line with the literature. In the study of Bonavolonta et al. in which they evaluated 1720 cases, assault was in the second place as the etiological cause.¹¹ In this study, similar to the result of Yamamoto et al.,⁵ fall/impact was the second etiological cause. When evaluated in terms of age, the main etiological patterns differed between the young patient group and the adult group. According to our study results, the most common causes of trauma were traffic accidents in adult patients and falls in young patients. Etiologically, assault cases are in the third place with a rate of 24.5%, followed by cases of falling from a height with a rate of 11%. Cases of falling from a height reflect the typical feature of the

Southeastern Anatolia region, and because of the extremely hot climatic conditions, the more intense use of open areas such as the roofs of the houses, especially the sleeping habits of people on the housetop during summer nights. One of the points that we need to emphasize, as one of the economic livelihoods in the region, especially in rural areas, is intensively maintained, is that animal kicks constitute 3.4% of the patients who applied to our faculty with maxillofacial trauma. Other etiological factors in our findings were work accidents with a rate of 1.6%, shot gun injuries with a rate of 1.6%, and pathological fractures because of tooth extraction with a rate of 1.6%.

All bones of the maxillofacial region are open to trauma. Many studies have been published on the localization of fractures in the facial bones as a result of trauma. It was reported that the most frequently broken bones were nasal bone and orbita.¹⁴ There is also a study reporting that the orbita is in the first place, followed by the maxilla, zygoma, nasal bone, and mandible, respectively.⁶ In addition to these, there are many studies reporting that the most frequently broken bone is the mandible.^{5,7,10,11,13} In this study, mandibular fractures (79.1%) were in the first place in line with the literature. Maxilla fractures were in the second place, followed by cases with combined maxilla and mandible fractures, combined fractures involving the midface bones and jaws, infraorbital rim fractures, and zygoma fractures.

When mandible fractures are evaluated according to the parts of the mandible, it has been reported that these fractures occur most frequently in the corpus.¹⁰ The same investigators reported that corpus fractures were followed by angle fractures. In a study, it was stated that the least fractured parts of the mandible were ramus and coronoid.⁴ Yamamoto et al. reported that fractures occur most frequently in the angle, second in the symphysis.⁷ Atilgan et al. reported that in adults symphysis/parasymphysis fractures occur most frequently, followed by condyle, corpus, and angle fractures.¹⁵ The same investigators reported that in children and young patients, symphysis/parasymphysis and condyle fractures were most common. Some investigators have reported that overall, between 75% and 90% of fractures occur in an almost equal distribution among the mandibular corpus, condyle, and angle.¹⁶ In this study, there were 24% condyle, 23% angulus, 19% parasymphysis, 12% symphysis, 5% corpus fractures, and in parallel with the literature, the least fractured part of the mandible is ramus with a rate of 1%.

Although non-life-threatening fractures may be treated under local anesthesia, complicated fractures that may pose life-threatening risks need to be operated under general anesthesia. Despite the lack of detailed information about the distribution of fracture treatments according to the type of anesthesia applied in the literature, the majority of the cases were treated under local anesthesia in our faculty. All infraorbital rim fractures and multi-traumatic complicated fractures with risk of airway obstruction were operated under general anesthesia. An intraoral approach was preferred as much as possible during the operation. The advantages of the intraoral approach are that there is no scarring, less time to reach the fracture line, and less morbidity. However, in cases where the intraoral approach is insufficient or not possible, the extraoral approach may be preferred.

The basic principles to be followed in the treatment of maxillofacial fractures are as follows: it is the debridement of bad tissues between the fragments, the reduction of the fractured segments in the anatomical position by providing occlusion, the provision

of immobilization, and the preservation of functions by preventing malunion and infections.¹⁷ Closed reduction (intermaxillary fixation) and open reduction techniques are used to fulfill these principles. Internal fixation method with open reduction has advantages such as early recovery, patient comfort, and faster return to function.¹⁸ Bali et al.,¹⁹ Norozy et al.,¹⁸ and Wusiman et al.²⁰ reported that they mostly used open reduction internal fixation method in fracture treatment. In this study, open reduction internal fixation was preferred in cases where the fracture line was displaced, in unfavorable angle fractures where fragments tend to separate because of muscle traction, in all infraorbital rim fractures, in infected fractures, and fractures in which the occlusion could not be corrected with intermaxillary fixation.

In this case series, similar to the results of Erol et al.,²¹ Bakardjiev et al.,²² and Yamamoto et al.,⁷ it was observed that the majority of the patients were treated with closed methods (75.61%). Intermaxillary fixation is an easy and economical method used in the treatment of mandibular-maxillary fractures, it can be performed in a short time without stressing the patient and gives satisfactory clinical results when indicated.²¹ The other advantages of this procedure are that the patient does not receive general anesthesia and there is no scarring.²¹ On the other hand, weight loss because of intermaxillary fixation may be considered a disadvantage. Periodontal problems may also develop because of the difficulty in maintaining oral hygiene.³ However, there is a study showing that periodontal disease that develops after arch bar use improves within 1 year at the latest.²³ In this study, no complications related to fracture healing developed in any of the cases treated with intermaxillary fixation.

Finally, if we focus on some limitations of this study, like other retrospective studies, this comprehensive analysis can be attributed to information bias due to missing records and documentation. Another limitation is that although it can be a comprehensive study for the epidemiological features of maxillofacial fractures in our region, it is difficult to predict the general trend of all maxillofacial injuries in Turkey. However, the study results provide an important guide for the establishment of preventive public health studies to reduce the frequency of maxillofacial trauma in the region.

CONCLUSION

The results obtained in light of the data of this study may be summarized as follows:

1. Maxillofacial fractures were most common in young patients aged between 0 and 12 years and adolescents aged between 12 and 18 years.
2. In terms of gender distribution, it was found that the number of men in the young patient group and in the adult patient group was higher than that of women.
3. The majority of the patients resided in our province, and the others were referred to us from different centers in the Southeastern Anatolian region.
4. When the etiological factors of fractures were evaluated, traffic accidents were in the first place and falls were in the second place.
5. In the distribution of maxillofacial fractures according to facial fractures, isolated mandible fractures were the first with a high rate (79.1%).
6. When mandibular fractures were evaluated within themselves, condyle fractures were in the first place, angle frac-

tures followed condyle fractures with a very small difference, and ramus fractures were seen with an incidence of 1% with the least frequency.

7. When the treatment methods were evaluated, it was observed that the majority of the patients were healed without complications by only intermaxillary fixation.
8. Most of the maxillofacial fractures were treated under local anesthesia.

The findings in our study were generally similar to those from other studies. It is concluded that some minor differences may be seen as a significant factor to the evaluation of the educational status, socioeconomic level, and climatic conditions of our region and that our research contributes to the literature.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Dicle University Faculty of Dentistry Local Ethics Committee (Date: December 29, 2021, Decision No: 2021-66).

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