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Prevalence, patient characteristics and treatment selection associated components of maxillofacial fractures: A clinical study

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Abstract

The etiology of maxillofacial fractures is closely related to society and lifestyles, cultural structure, and social values. Various methods are used in maxillofacial fracture surgery, and these methods are determined aesthetically and functionally. In our study, it was aimed to examine in detail the prevalence, patient characteristics, and treatment approach of patients with maxillofacial fractures. This study was carried out retrospectively, based on the records of patients with maxillofacial fractures treated in the last 10 years in our clinic. Descriptive statistics, t-test, and Kolmogorov-Smirnov test were used in data evaluation. The results were evaluated at a 95% confidence interval with a significance level of $p<0.05$. The total of 700 patients were examined. Most of the patients were between 0 and 30 years old, and their distribution is as follows; 21.9% of them were 0-10 years old, 24.7% of them were 11-20 years old and 24.4% of the patients were 21-30 years old. A total of 700 patients were included in the sample group. It was found that 29.1% of the patients developed maxillofacial fractures due to traffic accidents and 41.7% due to falling from a height. Intermaxillary fixation was applied to 32.1% of the patients, and open reduction internal fixation was applied to 60.7% (n=424) of the patients as a treatment method. Maxillofacial fractures are an important public health problem. Education and preventive practices should be planned at the community level. High-speed causing traffic accidents and not using seat belts should be avoided. Breaking the culture of sleeping on the terrace, specifically to the region where the study was conducted, may be effective in preventing traumas caused by falling from a height. The selection of appropriate treatment methods based on age and psychosocial parameters is very important in determining treatment options.

Keywords: Mandibular fracture, maxillofacial fractures, treatment selection

Introduction

The face and skull are open to many external factors, and it is almost impossible to protect one hundred percent against dangers. Maxillofacial traumas may be a simple abrasion and cut, or they may be complex injuries characterized by soft tissue injury and loss, as well as various bone fractures [1]. The aim in the treatment of maxillofacial fractures is not only to manage the wounds or to perform life-saving interventions, but also to eliminate the loss of function caused by the injury, to prevent the development of aesthetic problems, and to minimize the risk of dysfunctional facial expressions. The sequelae caused by maxillofacial fractures can detach individuals from their social life, business world, dreams, and future goals.

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The prevalence of maxillofacial fractures is affected by the environmental, social, and cultural values of societies and individuals, and these fractures are an important problem worldwide [2-5]. Maxillofacial fractures occur due to various problems. The most common of these problems can be listed as occupational injuries, attacks, traffic, and sports accidents [4,6,7]. The severity of the negative effects of maxillofacial fractures on individuals is determined by the type of fracture, the loss of function it causes, and the individual's social and economic conditions. Maxillofacial fractures are most common between the ages of 21-30 and in males [7-9]. When planning the treatment and management of maxillofacial fractures, the localization of the fracture, its severity and accompanying injuries should be considered. For this purpose, anamnesis of the patient is performed, and the maxillofacial region and teeth are examined using an appropriate imaging technique. Maxillofacial fractures are often complex, multiple, and asymmetrical. The localization, extent and displacement of the maxillofacial fracture have great importance [10,11]. After the necessary determinations, conservative, closed reduction, Intermaxillary Fixation (IMF) and/or Open Reduction

Internal Fixation (ORIF) are frequently used treatment protocols for maxillofacial fractures [12].

Elimination of maxillofacial fracture etiology is much more important than effective and reliable treatment methods applied to fractures. Providing training for young people to control their anger during fights, supervising and training drivers who drive fast or do not use seat belts, taking precautions against sports accidents, and preventing occupational injuries can be effective solutions. However, before all these solutions, there is a need for a better understanding of its prevalence and examination of large sample groups. In addition, the study of the treatment methods used in large sample groups is unique in gaining important insights into the clinical management of maxillofacial fractures. In our study, it was aimed to examine in detail the prevalence, patient characteristics and treatment approach of patients with maxillofacial fractures admitted to a university hospital.

Materials and Methods

Prior to the study, the ethical approvals were obtained from Dicle University Clinical Research Ethics Committee (Decision No: 25.03.2021-199). After the Ethics Committee Report was issued, access to patient records was provided. Patient confidentiality was considered, and only health records were accessed, identity information was not examined.

In this cross-sectional clinical study, records of patients with maxillofacial fractures admitted to a university hospital in southeast Turkey between January 1,2011, and December 31,2020, were retrospectively reviewed. Because of the relation to neurosurgical operations, cranial fractures (such as frontal, temporal, etc.) were excluded, while all maxillofacial fractures (including mandibular fractures) were included in this study. Patient data, computer-stored medical records, patient files and records of the Department of Plastic, Reconstructive and Aesthetic Surgery were reviewed retrospectively by the researcher. Keywords such as zygomatic arch, zygoma, orbital, nasoorbitoethmoid, maxilla, nasal, dentoalveolar, and mandibular fractures were entered into the computer records and data were obtained. All data were recorded in the information form. In this form, there are sociodemographic characteristics of the patients, imaging methods, information about the maxillofacial fracture, the operation process, the intervention and treatment and the length of hospital stay.

Descriptive statistical methods (Frequency, Standard Deviation, Arithmetic Mean) were used in data evaluation. The Chi-Square Test was used to determine the statistical significance of the differences between the mean values. Kolmogorov-Smirnov test was determined that the data did not show normal distribution. All findings were analyzed using IBM SPSS (Statistical Package for the Social Sciences) Statistics 25. The results were evaluated at a 95% confidence interval with a significance level of $p<0.05$.

Results

The total of 700 patients were examined. The characteristics of patients with maxillofacial trauma are given in Table 1. Accordingly, 21.9% (n=153) of the patients were 0-10 years old, 24.7% (n=173) of them were 11-20 years old, 24.4% (n=171) of them were 21-30 years old, 14.6% (n=102) were 31-40 years old, 6.7% (n=47) were 41-50 years old, 5.3% (n=37) were 51-60 years old and 2.4% (n=17) were over 60 years old. It was determined that 69.4% (n=486) of the patients were single and 80.4% (n=563) were male. The reasons for hospital admissions in patients with maxillofacial trauma are as follows: 29.1% (n=204) for traffic accidents, 15.3% (n=107) for assaults, 41.7% (n=292) for falling from a height, 3.4% (n= 24) for sports injuries, 2% (n=14) for occupational accidents, 0.6% (n=4) for explosions, 2.7% (n=19) for firearm injuries, 2.6% (n=18) for animal kicks and 2.6% (n=18) for home accidents.

When the distribution of treatment methods applied to maxillofacial fractures is analyzed, the results are as follows: conservative treatment for 5.6% (n=39) of the patients, closed reduction for 19.4% (n=136), IMF for 32.1% (n=225), ORIF for 60.7% (n=424) and ORIF+IMF for 45% (n=314). Trauma distribution by years of hospitalization is as follows: 10.6% (n=74) in 2011, 11.7% (n=82) in 2012, 11.7% (n=82) in 2013, 12% (n=84) in 2014, 14.2% (n=99) in 2015, 15.3% (n=107) in 2016, 10.2% (n=71) in 2017, 7.7% (n=54) in 2018, 4.1% (n=29) in 2019 and 2.5% (n=18) in 2020. Trauma distribution by month of hospitalization is as follows: 3.4% (n=24) in January, 5.1% (n=36) in February, 4% (n=28) in March, 5.4% (n=38) in April, 6.3% (n=44) in May, 6.4% (n=45) in June, 17.3% (n=121) in July, 16% (n=112) in August, 12.6% (n=88) in September, 12.5% (n=87) in October, 6.7% (n=47) in November and 4.3% (n=30) in December. It was determined that the presence of accompanying trauma in patients with maxillofacial trauma was 70%, and the average length of hospital stay was 15.1±4.2 days (min=3, max=45 days).

The distribution of maxillofacial fractures by localization is shown in Table 2. The types of fractures in the patients are as follows: 15.3% (n=107) for zygomatic arch fractures, 16.9% (n=18) for zygoma fractures, 18.6% (n=130) for orbital fractures, 2.6% (n=18) for naso-orbitoethmoid fractures, 25.1% (n=176) for maxilla fractures, 4.1% (n=29) for nasal fractures, and 5.6% (n=39) for dentoalveolar fractures. In addition, 16.7% (n=87) for mandibular parasymphyseal fractures, 1.9% (n=10) for mandibular coronoid fractures, 4% (n=21) for mandibular ramus fractures, 16.3% (n=85) for mandibular symphyseal fractures, 15.7% (n=82) for mandibular corpus fractures, 13.8% (n=72) for mandibular angle fractures, 31.5% (n=164) for mandibular condyle fractures. It was determined that all mandibular fractures constituted 74.4% (n=521) of maxillofacial fractures.

Table 3 shows the treatment methods applied to maxillofacial fractures. Accordingly, it was determined that closed reduction was applied to zygomatic arch fractures (15.3%), and ORIF was applied to zygoma (16.9%), orbital (18.6%) and naso-orbitoethmoid (2.6%) fractures. It was determined that ORIF and ORIF+IMF were applied to maxillary fractures at the rate of 8.6% and 16.6%, respectively. It was determined that closed reduction was applied to nasal fractures (4.1%) and conservative treatment was applied to dentoalveolar fractures (5.6%). It was determined that ORIF+IMF (6%) was applied to patients with mandibular parasymphyseal fractures, IMF (1.4%) to patients with mandibular coronoid fractures, ORIF+IMF (1.6%) to mandibular ramus fractures, IMF (19.7%) to mandibular condyle fractures. It was also determined that ORIF+IMF (5%) was applied to mandibular angle fractures, ORIF+IMF (6.9%) to mandibular corpus fractures, and ORIF+IMF (6.3%) to mandibular symphyseal fractures.

Table 1. Characteristics of patients with maxillofacial fractures (n=700)

Characteristics	n	%
Age Groups (Years)		
0-10	153	21.9
11-20	173	24.7
21-30	171	24.4
31-40	102	14.6
41-50	47	6.7
51-60	37	5.3
Over 60	17	2.4
Marital Status		
Married	214	30.6
Single	486	69.4
Gender		
Male	563	80.4
Female	137	19.6
Etiology of Trauma		
Traffic Accidents	204	29.1
Assault	107	15.3
Falling from a height	292	41.7
Sports Injuries	24	3.4
Occupational Accidents	14	2.0
Explosion	4	0.6
Firearm Injury	19	2.7
Animal Kicks	18	2.6
Home Accidents	18	2.6
Accompanying Trauma		
Yes	490	70
No	210	30
Applied Treatment		
Conservative	39	5.6
Closed Reduction	136	19.4
IMF	225	32.1
ORIF	424	60.7
ORIF+IMF	314	45
Trauma Distribution by Years of Hospitalization		
January 1-December 31, 2011	74	10.6
January 1-December 31, 2012	82	11.7
January 1-December 31, 2013	82	11.7
January 1-December 31, 2014	84	12
January 1-December 31, 2015	99	14.2
January 1-December 31, 2016	107	15.3
January 1-December 31, 2017	71	10.2
January 1-December 31, 2018	54	7.7
January 1-December 31, 2019	29	4.1
January 1-December 31, 2020	18	2.5
Trauma Distribution by Month of Hospitalization		
January	24	3.4
February	36	5.1
March	28	4.0
April	38	5.4
May	44	6.3
June	45	6.4
July	121	17.3
August	112	16.0
September	88	12.6
October	87	12.5
November	47	6.7
December	30	4.3
Length of Hospital Stay (Days) (Mean±SD)	**15.1±4.2**	**Min 3, Max 45**

IMF: Intermaxillary Fixation ORIF: Open Reduction Internal Fixation
SD: Standard Deviation Min: Minimum Max: Maximum

Table 2. Distribution of maxillofacial fractures by localization (n=700)

Fracture Type*		n	%
Zygomatic Arch		107	15.3
Zygoma		118	16.9
Orbital		130	18.6
Nasoorbitoethmoid		18	2.6
Maxilla		176	25.1
Nasal		29	4.1
Dentoalveolar		39	5.6
Mandibular fracture (n=521, 74.4%)	Parasymphyseal	87	16.7
	Coronoid	10	1.9
	Ramus	21	4.0
	Symphyseal	85	16.3
	Body	82	15.7
	Angle	72	13.8
	Condylar	164	31.5

* Patients with more than one type of fracture are included

Table 3. Treatment methods applied to maxillofacial fractures (n=700)

Fracture Type	Treatment Methods	n	%
Zygomatic Arch	Closed Reduction (Gillies Approach)	107	15.3
Zygoma	ORIF	118	16.9
Orbital	ORIF	130	18.6
Naso-orbitoethmoid	ORIF	18	2.6
Maxilla	ORIF	60	8.6
	ORIF+IMF	116	16.6
Nasal	Closed Reduction	29	4.1
Dentoalveolar	Conservative	39	5.6
Mandibular Parasymphyseal	IMF	27	3.9
	ORIF	18	2.6
	ORIF+IMF	42	6
Mandibular Coronoid	IMF	10	1.4
Mandibular Ramus	IMF	8	1.1
	ORIF	2	0.3
	ORIF+IMF	11	1.6
Mandibular Symphyseal	IMF	18	2.6
	ORIF	23	3.3
	ORIF+IMF	44	6.3
Mandibular Body	IMF	8	1.1
	ORIF	26	3.7
	ORIF+IMF	48	6.9
Mandibular Angle	IMF	16	2.3
	ORIF	21	3
	ORIF+IMF	35	5
Mandibular Condylar	IMF	138	19.7
	ORIF	8	1.1
	ORIF+IMF	18	2.6

IMF: Intermaxillary Fixation ORIF: Open Reduction Internal Fixation

Discussion

Society and lifestyles vary from country to country. The etiology of maxillofacial fractures is mostly preventable and is closely related to the society's values and lifestyle. Maxillofacial fractures are a global problem that can be seen all over the world [13-15]. In the literature review, it is stated that most maxillofacial fractures are caused by traffic accidents. The region that we conducted our study

has some specific conditions. One of these specific conditions is that individuals sleep on the terrace of their houses in the summer period due to hot weather. There is no balcony rail on the edge of the terraces, and the houses are generally single-storey and detached structures. Individuals sleeping on the terrace may fall from the terrace without being aware of it when they wake up due to sleepiness or drowsiness and may suffer from a maxillofacial fracture. Indeed, in our study, 41.7% of the patients applied to the hospital with the complaint of falling from a height and were treated for maxillofacial fracture. The increase in maxillofacial fractures in July and August may also be related to the increase in the population sleeping on the terrace during the summer months.

Providing training for young people to control their anger during fights, supervising and training drivers who drive fast or do not use seat belts, taking precautions against sports accidents, and preventing occupational injuries can be effective solutions. In addition, breaking the culture of sleeping on the terrace, specifically to the region where the study was conducted, may be effective in preventing traumas caused by falling from a height.

In our study, 29.1% (n=204) of the patients suffered from maxillofacial fractures due to traffic accidents, and traffic accidents ranked second in our study as an etiological factor. In the literature, it is stated that traffic accidents take the first place in the etiology of maxillofacial fractures worldwide [15-18]. Patients with maxillofacial fractures due to traffic accidents are generally male and under 30 years old [19-21]. In our study, 80.4% of the patients were male. The age ranges of the patients were as follows; 21.9% of them were 0-10 years old, 24.7% of them were 11-20 years old and 24.4% of the patients were 21-30 years old. The results of our study support the literature. Maxillofacial fractures caused by motorcycle accidents are accompanied by multiple traumas in other parts of the body, and therefore, the length of hospital stay is prolonged [15,22]. In our study, it was determined that the rate of accompanying multi-trauma was 14% and the length of hospital stay was 15.1±4.2 (min 3, max 45) days.

In our study, 74.4% (n=521) of maxillofacial fractures were mandibular fractures. Among the most common mandibular fractures, condyle fractures are in the first place with a rate of 31.5% (n=164), parasymphyseal fractures are in the second place with a rate of 16.7% (n=87), and symphyseal fractures are in the third place with a rate of 16.3% (n=85). In the literature, the most common type of fracture is mandibular fractures with a rate of more than 50% [23-26]. After mandibular fractures, zygomatic facial fractures are the second most common maxillofacial fractures [23,24,27]. In our study, 15.3% (n=107) of maxillofacial fractures were zygomatic arch fractures and 16.9% (n=18) of them were zygoma fractures. When the rates of both zygoma fractures are combined, zygomatic facial fractures take the second place after mandibular fractures. The types and rates of maxillofacial fractures found in our study support the results of the literature. In the literature, other body traumas accompanying maxillofacial traumas with a rate of 71.5% have been emphasized [23,28]. In our study, it was determined that the rate of other accompanying body traumas was similar (70%).

In our study, when the distribution according to the treatment methods applied to maxillofacial traumas is examined, the treatments applied to the patients are as follows; conservative treatment for 5.6% (n=39) of the patients, closed reduction for 19.4% (n=136), IMF for 32.1% (n=225), ORIF for 60.7% (n=424) and ORIF+IMF for 45% (n=314). In similar studies, maxillofacial fractures were treated most with ORIF at a rate of 57.5% [29-31]. ORIF, widely used in the literature and in our findings, is considered advantageous since it provides bone stabilization and precise anatomical reduction [23].

According to other results of our study, it was determined that closed reduction was applied to zygomatic arch fractures (15.3%), and ORIF was applied to zygoma (16.9%), orbital (18.6%) and naso-orbitoethmoid (2.6%) fractures. It was determined that ORIF and ORIF+IMF were applied to maxillary fractures at the rate of 8.6% and 16.6%, respectively. It was determined that closed reduction was applied to nasal fractures (4.1%) and conservative treatment was applied to dentoalveolar fractures (5.6%). It was determined that ORIF+IMF (6%) was applied to patients with mandibular parasymphyseal fractures, IMF (1.4%) to patients with mandibular coronoid fractures, ORIF+IMF (1.6%) to mandibular ramus fractures, IMF (19.7%) to mandibular condyle fractures. It was also determined that ORIF+IMF (5%) was applied to mandibular angle fractures, ORIF+IMF (6.9%) to mandibular corpus fractures, and ORIF+IMF (6.3%) to mandibular symphyseal fractures.

The choice of the treatment plan is made according to the location of the maxillofacial fracture, its type, minimal scarring, motor nerve complications, and the best functional and aesthetic results [32-34]. In our study, there was no significant relationship between treatment choices and the age of the patients. However, in the literature, it was stated that the osteogenic potential of pediatric patients may increase the risk of tooth bud injuries caused by ORIF and may result in facial asymmetry, closed reduction is a good treatment choice in pediatric patients, and closed reduction is also considered ideal for the geriatric patients [23,35,36]. Instead of grouping the patients according to their ages in determining the treatment choice, patient-centered care/patient-specific therapy is a more ideal and modern method.

The aim of maxillofacial fracture surgery is not only to save a life, but also to eliminate aesthetic or functional disorders. Appropriate treatment methods should be determined for maxillofacial fractures, and the treatment should be performed with the correct techniques. In determining treatment options, the selection of appropriate treatment methods based on patient needs is very important. In this regard, the psychosocial and financial impact of surgery should not be forgotten. For this reason, it has great importance to determine the etiology, prevalence, patient characteristics, localization, and treatment plans of maxillofacial traumas.

According to the findings of our study, falling from a height and traffic accidents are the two most common etiological factors. It was found that maxillofacial fractures were seen more common in men and under 30 years old compared to other individuals, and the highest number of cases was in July and August. In addition, the most common types of fractures are mandibular fractures, zygomatic facial fractures, and condyle fractures, respectively. The most used treatment methods are ORIF and ORIF+IMF, respectively.

Conclusion

Maxillofacial fractures are an important public health problem.

Education and preventive practices at the community level have great importance. The most important parameter in its prevention is the elimination of etiological factors. The data obtained in our study is an important source of information in terms of both the sample size and the scope of the data.

Conflict of interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical approval
Prior to the study, the ethical approvals were obtained from Dicle University Clinical Research Ethics Committee (Decision No: 25.03.2021-199).

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