RESEARCH ARTICLE

CYPRUS
JOURNAL OF MEDICAL SCIENCES

DOI: 10.4274/cjms.2026.2025-60
Cyprus J Med Sci 2026;11(2):120-127

Mandibular Fractures Between 2014 and 2024: A 10-Year Retrospective Study

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Abstract

BACKGROUND/AIMS: Mandibular fractures are a common type of maxillofacial fracture. Clinical symptoms of mandibular fractures include pain, swelling, difficulty chewing, and malocclusion. Collecting long-term epidemiological data on mandibular fractures can provide essential information for developing and evaluating preventive measures to reduce the incidence of these facial injuries.

MATERIALS AND METHODS: Ethical approval for the study was obtained prior to data collection. Patient information was retrieved from hospital records, radiological images, official reports, and the institutional information management system. Data from a single tertiary care center were reviewed, including demographic characteristics, fracture sites, and treatment methods for mandibular fractures in 185 patients treated between February 2014 and February 2024. Only patients with complete clinical and radiographic documentation were included, and the data were independently assessed by two researchers to ensure accuracy and consistency.

RESULTS: Among the 185 patients examined, fractures were most frequently observed in the 20-29 age group. Assault was identified as the leading cause of mandibular fractures in men, while falls were the most common cause in women. The incidence of fractures increased during the summer months. The mean number of fractures per person was 1.34. The region most frequently associated with mandibular fractures was the angle of the mandible.

CONCLUSION: Mandibular fractures commonly occur in young males. Properly planned treatments for these fractures yield high success rates. The findings of this study provide insights to surgeons, physicians, and health policymakers on addressing mandibular fractures.

Keywords: Etiology, mandibular fractures, retrospective studies

INTRODUCTION

The mandible, which is U-shaped, is the largest bone in the facial skeleton.[1] It is the only facial bone capable of movement through a joint and is particularly prone to trauma due to its protruding structure. Its functions include speech, mastication, and swallowing, all of which can be disrupted by mandibular fractures.

Mandibular fractures account for between 18.0% and 72.9% of all facial fractures.[2] This wide range is attributable to regional, demographic, and etiological differences among studies. Mandibular fractures occur after blunt or penetrating trauma. In addition, weakness in the mandible caused by tooth extraction, tumor, or cyst can cause pathological fractures. Although the etiologies are difficult to classify, the most common causes of fractures are assaults, falls, sports injuries, motor vehicle accidents (MVAs), and pathological conditions. Among these, the factors most responsible for fracture formation are MVAs, assaults, and falls.[3-6]

Across demographic studies, men consistently sustain mandibular fractures more frequently than women.[6-8] The most affected age group

To cite this article: Türkan Ö, Kahraman S, Yılmaz A. Mandibular fractures between 2014 and 2024: a 10-year retrospective study. Cyprus J Med Sci. 2026;11(2):120-127

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Received: 18.06.2025
Accepted: 14.01.2026
Epub: 11.03.2026
Publication Date: 22.04.2026

is typically between 21 and 34 years of age.[3,7,9] The epidemiology of facial fractures varies greatly across countries and may be explained by differences in economic and social conditions, local behavioral patterns, and legislation.

This study is a retrospective analysis of all treated mandibular fractures from 2014 to 2024. The aim of the study is to determine the frequency of mandibular fractures in males and females, identify the most commonly affected age groups, analyze the injury mechanisms, and report the treatment methods applied. The findings may contribute to the current understanding of mandibular fractures, inform clinical practice and research in this field, and serve as a reference for future studies. Additionally, they may help develop evidence-based guidelines and policies for the prevention, diagnosis, and treatment of these injuries.

MATERIALS AND METHODS

Ethical Approval

Ethical approval for this study was obtained from the Gazi University Rectorate Ethics Committee (approval number: 08, date: 18.04.2023).

Sample Size and Characteristics

In this retrospective study, 185 patients who presented to Gazi University Faculty of Dentistry Hospital with mandibular fractures between February 2014 and February 2024 were analyzed. Data were obtained from patient records, self-reports, radiological images and reports, and the hospital information management system, Metasoft (Metasoft Computer Information Processing Services Co. Ltd., Eskişehir, Türkiye). The analyzed data included patient age, gender, date of trauma, fracture location, and treatment methods.

Patients were included if they were diagnosed with isolated mandibular fractures between 2014 and 2024, had complete clinical and radiographic records, and had at least two months of post-treatment follow-up with available control radiographs. Patients presented with concomitant panfacial fractures, pathological fractures (e.g., cysts, tumors, osteomyelitis), secondary fractures following surgical interventions, or radiological image artifacts that affected diagnostic quality. Cases with incomplete medical records or missing radiographic data were also excluded.

Collected Data

Age data were categorized by decade. Fracture etiologies were classified into five categories: assaults, falls, sports injuries, MVAs, and other causes. Seasonal and monthly distributions were also analyzed. Fracture locations were classified as corpus, angulus, ramus, symphysis, parasymphysis, condyle, and coronoid based on patients' radiographic images. This anatomical classification was derived from the localization section of the Dingman and Natvig[10] mandibular fracture classification. This classification was preferred because it is common and easy to use. In addition to fracture locations, the number of fractures was considered because some cases involved multiple fractures. Treatment methods were documented using radiological images, patient files, and self-reports.

Statistical Analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows, version 27 (SPSS Inc., Chicago, IL, USA). Descriptive statistics (frequencies and percentages) were presented for the variables. The differences in frequency distributions between categorical variables were examined using the chi-square test. According to the assumptions of the chi-square test, when more than 20% of the expected cell frequencies were less than 5, the Fisher-Freeman-Halton test was applied instead. A significance level of $\alpha=0.05$ was adopted for all statistical analyses.

RESULTS

Age and Gender

Among the 185 patients included in the study, 135 were male (72.97%), and 50 were female (27.02%), with a male-to-female ratio of 2.7:1. Patients were grouped into seven age categories: 0-9, 10-19, 20-29, 30-39, 40-49, 50-59, and 60 and above. The 20-29 age group was the most affected, accounting for 44.3% of cases (Figure 1).

Seasonal and Monthly Distribution

Mandibular fractures recorded between February 2014 and February 2024 showed a peak incidence in September. Fracture cases were higher during the summer months (Figure 2).

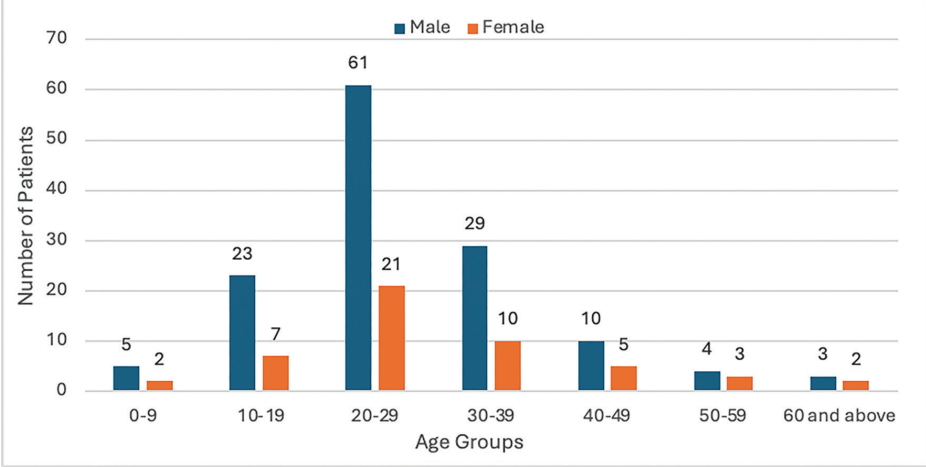

Figure 1. Age and sex distribution.

Etiology

Mandibular fractures were categorized into five main etiological groups: assault, falls, MVAs, sports injuries, and other causes. Assault was the leading cause of mandibular fractures (40.0%), followed by falls (32.4%) and MVAs (21.1%). Assault-related fractures were significantly more frequent among males (χ^2=9.250, p=0.002). The predominant etiology among females was falls. The "other causes" group included one case caused by an earthquake and one caused by an animal attack (Table 1).

Fracture Frequency and Location

A total of 249 fractures were detected in 185 patients, ranging from one to three fractures per patient. The mean number of fractures per patient was 1.34. Among the cases, 124 (67.02%) had a single fracture, 58 (31.35%) had two fractures, and 3 (1.62%) had three fractures in different locations.

The mandibular angle was the most common site (25.3%), followed by the condyle (22.9%) and the symphysis (22.5%) (Figure 3).

Angle fractures were significantly more frequent in assault-related cases (p<0.001), whereas condylar fractures were more common in non-assault cases (p<0.001) (Table 2). Condylar fractures were significantly more frequent among patients with falls (p<0.001), whereas angle fractures were significantly less common in this group (p<0.001) (Table 3). Angle fractures were significantly less frequent in MVA-related patients (p=0.017), whereas symphysis fractures were significantly more common (p=0.042). No statistically significant differences were found for MVA-related patients with condylar, body, ramus, or coronoid fractures (p>0.05), although condylar (p=0.086) and body (p=0.066) fractures approached significance (Table 4).

Among the 58 cases with two fracture lines, the most common combination was fractures of the angle and body (n=13). The angle region showed the strongest association with multiple fractures (Table 5).

Additionally, fractures were observed in three anatomical regions among three cases. Two cases involved bilateral condylar and symphyseal fractures, while the third had fractures of the symphysis, body, and condyle.

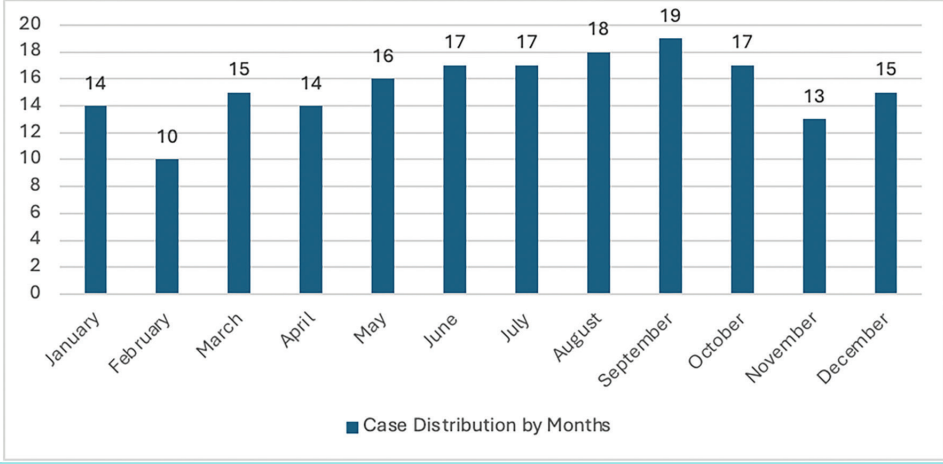

Figure 2. Monthly distribution of mandibular fractures.

Table 1. Distribution of mandibular fracture etiologies by gender

Fracture etiology		Gender									Test statistics	p
		Male			Female			Total				
		n	Row n %	Column n %	n	Row n %	Column n %	n	Row n %	Column n %		
Assault	No	72	64.9	53.3	39	35.1	78.0	111	100.0	60.0	χ^2=9.250	0.002*
	Yes	63	85.1	46.7	11	14.9	22.0	74	100.0	40.0		
Falls	No	95	76.0	70.4	30	24.0	60.0	125	100.0	67.6	χ^2=1.791	0.181
	Yes	40	66.7	29.6	20	33.3	40.0	60	100.0	32.4		
MVA	No	111	76.0	82.2	35	24.0	70.0	146	100.0	78.9	χ^2=3.276	0.070
	Yes	24	61.5	17.8	15	38.5	30.0	39	100.0	21.1		
Sports	No	128	73.1	94.8	47	26.9	94.0	175	100.0	94.6	-	1.000
	Yes	7	70.0	5.2	3	30.0	6.0	10	100.0	5.4		
Other	No	134	73.2	99.3	49	26.8	98.0	183	100.0	98.9	-	0.469
	Yes	1	50.0	0.7	1	50.0	2.0	2	100.0	1.1		

*p<0.05, χ^2: Chi-square test statistic.
MVA: Motor vehicle accident.

Treatment Methods

Among the 185 patients analyzed, 9 (4.9%) were managed conservatively, without surgical intervention. These patients had functional limitations, were placed on a soft diet, and underwent regular clinical and radiographic follow-up.

Closed reduction with intermaxillary fixation (IMF) was applied in 29 patients (15.7%). Among these, 11 were treated with arch bars, 15 with IMF screws, and 3 with orthodontic brackets.

A total of 65 patients (35.1%) underwent open reduction with adjunctive IMF. In these cases, IMF was applied perioperatively to support occlusal stabilization, followed by fixation with miniplates. Among these patients, 36 had IMF removed after miniplate fixation, whereas the remaining 29 had IMF maintained postoperatively alongside miniplate fixation. These patients predominantly presented with multiple fracture sites, requiring both open and closed methods to achieve stable occlusion and fracture healing.

Finally, open reduction and internal fixation (ORIF) was performed on 82 patients (44.3%), constituting the most frequently used treatment modality. Among these, 69 cases were fixed with miniplates, 3 with three-dimensional plates, 1 with lag screws, and 9 with reconstruction plates (Table 6).

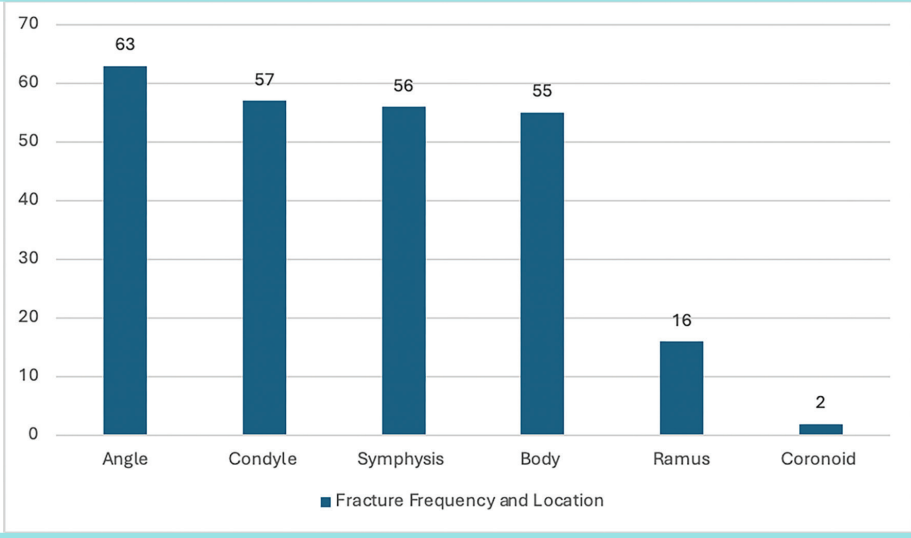

Figure 3. Distribution of cases according to fracture localization.

Table 2. Frequencies of fracture locations in assault-related cases

Fracture localization		Fracture etiology assault									Test statistics	p
		No			Yes			Total				
		n	Row n %	Column n %	n	Row n %	Column n %	n	Row n %	Column n %		
Angle	No	93	76.2	83.8	29	23.8	39.2	122	100.0	65.9	χ^2=39.318	<0.001*
	Yes	18	28.6	16.2	45	71.4	60.8	63	100.0	34.1		
Condyle	0	59	44.7	53.2	73	55.3	98.6	132	100.0	71.4	53.658	<0.001*
	1	48	98.0	43.2	1	2.0	1.4	49	100.0	26.5		
	2	4	100.0	3.6	0	0.0	0.0	4	100.0	2.2		
Symphysis	No	77	59.7	69.4	52	40.3	70.3	129	100.0	69.7	χ^2=0.017	0.896
	Yes	34	60.7	30.6	22	39.3	29.7	56	100.0	30.3		
Body	0	79	59.8	71.2	53	40.2	71.6	132	100.0	71.4	0.992	0.712
	1	30	58.8	27.0	21	41.2	28.4	51	100.0	27.6		
	2	2	100.0	1.8	0	0.0	0.0	2	100.0	1.1		
Ramus	No	101	59.8	91.0	68	40.2	91.9	169	100.0	91.4	χ^2=0.046	0.831
	Yes	10	62.5	9.0	6	37.5	8.1	16	100.0	8.6		
Coronoid	No	109	59.6	98.2	74	40.4	100.0	183	100.0	98.9	-	0.517
	Yes	2	100.0	1.8	0	0.0	0.0	2	100.0	1.1		

*p<0.05, χ^2: Chi-square test statistic.

Table 3. Frequencies of fracture locations in fall-related cases

Fracture localization		Fracture etiology falls									Test statistics	p
		No			Yes			Total				
		n	Row n %	Column n %	n	Row n %	Column n %	n	Row n %	Column n %		
Angle	No	69	56.6	55.2	53	43.4	88.3	122	100.0	65.9	χ^2=19.818	<0.001*
	Yes	56	88.9	44.8	7	11.1	11.7	63	100.0	34.1		
Condyle	0	105	79.5	84.0	27	20.5	45.0	132	100.0	71.4	29.427	<0.001*
	1	18	36.7	14.4	31	63.3	51.7	49	100.0	26.5		
	2	2	50.0	1.6	2	50.0	3.3	4	100.0	2.2		
Symphysis	No	85	65.9	68.0	44	34.1	73.3	129	100.0	69.7	χ^2=0.546	0.460
	Yes	40	71.4	32.0	16	28.6	26.7	56	100.0	30.3		
Body	0	86	65.2	68.8	46	34.8	76.7	132	100.0	71.4	1.451	0.447
	1	37	72.5	29.6	14	27.5	23.3	51	100.0	27.6		
	2	2	100.0	1.6	0	0.0	0.0	2	100.0	1.1		
Ramus	No	115	68.0	92.0	54	32.0	90.0	169	100.0	91.4	χ^2=0.205	0.651
	Yes	10	62.5	8.0	6	37.5	10.0	16	100.0	8.6		
Coronoid	No	124	67.8	99.2	59	32.2	98.3	183	100.0	98.9	-	0.545
	Yes	1	50.0	0.8	1	50.0	1.7	2	100.0	1.1		

*p<0.05, χ^2: Chi-square test statistic.

Table 4. Frequencies of fracture locations in motor vehicle accident cases

Fracture localization		Fracture etiology MVA									Test statistics	p
		No			Yes			Total				
		n	Row n %	Column n %	n	Row n %	Column n %	n	Row n %	Column n %		
Angle	No	90	73.8	61.6	32	26.2	82.1	122	100.0	65.9	χ^2=5.708	0.017*
	Yes	56	88.9	38.4	7	11.1	17.9	63	100.0	34.1		
Condyle	0	109	82.6	74.7	23	17.4	59.0	132	100.0	71.4	4.878	0.086
	1	35	71.4	24.0	14	28.6	35.9	49	100.0	26.5		
	2	2	50.0	1.4	2	50.0	5.1	4	100.0	2.2		
Symphysis	No	107	82.9	73.3	22	17.1	56.4	129	100.0	69.7	χ^2=4.154	0.042*
	Yes	39	69.6	26.7	17	30.4	43.6	56	100.0	30.3		
Body	0	106	80.3	72.6	26	19.7	66.7	132	100.0	71.4	5.636	0.066
	1	40	78.4	27.4	11	21.6	28.2	51	100.0	27.6		
	2	0	0.0	0.0	2	100.0	5.1	2	100.0	1.1		
Ramus	No	133	78.7	91.1	36	21.3	92.3	169	100.0	91.4	-	1.000
	Yes	13	81.3	8.9	3	18.8	7.7	16	100.0	8.6		
Coronoid	No	145	79.2	99.3	38	20.8	97.4	183	100.0	98.9	-	0.378
	Yes	1	50.0	0.7	1	50.0	2.6	2	100.0	1.1		

*p<0.05, χ^2: Chi-square test statistic.
MVA: Motor vehicle accident.

Table 5. Patients with two fracture lines	
Fracture site	**Patient**
Angle & condyle	4
Angle & symphysis	11
Angle & body	13
Angle & ramus	2
Condyle & symphysis	10
Condyle & body	5
Condyle & ramus	1
Symphysis & body	6
Symphysis & ramus	2
Bilateral body	2
Bilateral condyle	2

Table 6. Distribution of treatment methods among patients		
Treatment	**Patient**	**Percentage (%)**
Conservative management	**9**	**4.86**
Closed reduction	**29**	**15.68**
- IMF with arch bars	11	5.95
- IMF with IMF screws	15	8.11
- IMF using orthodontic brackets	3	1.62
Open reduction with adjunctive IMF	**65**	**35.13**
- IMF removed after miniplate placement	36	19.46
- Miniplate and IMF applied together	29	15.68
Open reduction and internal fixation	**82**	**44.32**
- Fixation with miniplates	69	37.30
- Fixation with 3D plates	3	1.62
- Fixation with lag screws	1	0.54
- Fixation with reconstruction plates	9	4.86
IMF: Intermaxillary fixation, 3D: Three-dimensional.		

DISCUSSION

The mandible is one of the most frequently fractured bones in the facial skeleton.[11] These fractures can result from trauma, pathological destruction caused by cysts and tumors, or surgical interventions such as tooth extractions. Researchers analyze case series of mandibular fractures, examining demographic, clinical, and radiographic data to identify patterns, trends, and factors associated with these injuries. Retrospective data on mandibular fractures are critical for developing effective prevention strategies and accurate trauma assessment protocols. The absence of recent studies on mandibular fractures at our clinic motivated us to re-examine our data.

Our study primarily focused on the demographic distribution of mandibular fractures. Factors such as age and gender were evaluated for their effects on fracture incidence. Of the 185 patients we treated, 135 were male and 50 were female, with a male-to-female ratio of 2.7:1. The higher incidence of fractures among males is consistent with findings in the literature.[3,9,12]

When patients were evaluated by age, fractures were most frequently observed in the second and third decades of life. This result is highly consistent with the literature.[3,12-14] The higher physical activity levels of this age group may explain their increased susceptibility to trauma. The findings suggest that mandibular fractures are more common among young males.

Mandibular fractures were observed most frequently in the summer.[15] Although it was hypothesized that severe winter conditions, such as heavy snow and ice, would increase the incidence of mandibular fractures in our region by causing slips, falls, and traffic accidents, our results indicated a higher incidence during the summer. Similarly, a previous study conducted at our faculty found an increase in fractures during the summer months.[16] This can be explained by increased physical activity during the summer. In our study, fractures were most common in September and least common in February.

Jin et al.[17] reported that among 2,076 patients, males aged 10 to 39 years were the most numerous. Patient numbers were significantly higher mid-month. Contrary to the findings in the literature, the relationship between fracture patterns and seasonality was examined in our study, and no seasonal differences were found.[17]

Silva et al.[18] reported that there was no significant seasonal difference in mandibular fractures in a study conducted in Brazil. They suggested that this might be due to the smaller seasonal differences in warm-temperate climates.[18]

When examining the etiology of fractures, assault was identified as the most common cause (n=74). Mandibular fractures are frequently associated with assaults and MVAs.[3,4,19,20] Falls were the second most common cause, accounting for 60 cases. Among women, falls were the most common etiological factor. Afrooz et al.[3] reported, that, in the United States, women were more affected by MVAs than men. Increased safety measures in motor vehicles have been found to reduce the incidence of facial injuries.[3,21]

Many studies report varying incidence rates for the most commonly fractured regions of the mandible, such as the symphysis, condyle, angle, and body.[3,9] In our study, the mandibular angle was the most frequently fractured region, followed by the condyle and the body of the mandible. When analyzing the relationship between the anatomical location of the fracture and the etiology, angle fractures were most frequently associated with assaults and sports injuries, while condylar fractures resulted from falls or MVAs.[3,19] Fractures of the mandible generally occur due to direct trauma, whereas fractures of the condylar region are typically due to indirect trauma.

Among the 185 patients we examined, 124 (67.02%) had a single fracture line in the mandible, 58 (31.35%) had two fracture lines, and 3 (1.62%) had three fracture lines. The literature suggests that the likelihood of observing single fractures was higher in our study.[11,22] This could be because our clinic is not the primary center where these trauma patients initially present; instead, patients often seek treatment at our clinic after their emergency care is completed, while more complex cases are treated at other centers.

The timing of treatment initiation for mandibular fractures is relatively important. Published studies have shown no difference in complication rates between starting treatment within 72 hours and starting treatment after 72 hours.[23-25] Although the timing of treatment is important, proper treatment planning is generally given priority. Diagnosing fractures can be challenging since mandibular fractures often occur

alongside other injuries. Delayed mandibular fractures can complicate reduction because of fibrin deposition at the fracture line. It should be remembered that every mandibular fracture is unique. Therefore, the timing of treatment should be individualized for each patient.

Treatment of mandibular fractures may involve various methods depending on the type, location, and severity of the fracture, as well as the patient's general health. In our series, 9 patients (4.9%) were managed conservatively, 29 (15.7%) underwent closed reduction, and most required open techniques. Hassanein[26] reported a conservative treatment rate of 4.38% in a study of 1,371 patients, which is consistent with our findings. A particularly noteworthy finding was that 65 patients (35.1%) who underwent open reduction with adjunctive IMF. Among these, 36 patients had IMF removed after miniplate fixation, whereas in the remaining 29 patients, IMF was maintained postoperatively in combination with miniplate fixation. In these patients, IMF was sometimes applied before surgery and in other cases after surgery, reflecting the need for individualized strategies in complex fracture patterns. Such cases were predominantly those involving multiple fracture sites, including condylar fractures combined with another mandibular fracture, in which integrating both open and closed principles was beneficial. This observation is consistent with the current literature, which indicates that tooth-bearing fractures are generally stabilized by ORIF, whereas condylar fractures may be managed with closed techniques, depending on displacement, loss of ramus height, and occlusal stability.[27] Finally, 82 patients (44.3%) underwent ORIF alone, consistent with recent reports highlighting this method as the preferred approach in contemporary mandibular trauma management.[14,15,26,27] Different treatment methods have their respective advantages and disadvantages, and the literature does not provide evidence that any single method is universally superior.

Study Limitations

This study is based on a retrospective analysis and is subject to certain data limitations. For example, our study focused only on data from a specific time period. Future studies with a larger dataset and a longer time period may address these limitations.

CONCLUSION

Mandibular fractures primarily affect young adult males; the leading causes vary by gender, commonly assaults and falls. The angle of the mandible was the most frequently fractured site, while condylar fractures were more often associated with falls and MVAs. Fracture incidence peaked during the summer months, reflecting increased outdoor physical activity; open reduction with internal fixation remained the most reliable treatment method.

From a preventive perspective, public health strategies focusing on violence reduction, particularly among young males, may help decrease the burden of mandibular trauma.

In clinical practice, we recommend that these patients be managed in specialized trauma centers through a multidisciplinary approach led by maxillofacial surgeons. Centralization of care not only ensures standardized, evidence-based management but also facilitates the collection of high-quality data, which will strengthen future research and contribute to the development of precise, evidence-based guidelines.

MAIN POINTS

- Mandibular fractures are most common among young males. The male-to-female ratio was 2.7:1.
- The most affected age group consisted of patients in their 20s, followed by those in their 30s and those in their teens.
- The etiological factors for mandibular fractures were assaults, falls, motor vehicle accidents, and sports injuries.
- On average, 1.34 fractures occurred per person, and the most frequently fractured site was the angle.
- The most commonly used treatment method is miniplate fixation.

ETHICS

Ethics Committee Approval: Ethical approval for this study was obtained from the Gazi University Rectorate Ethics Committee (approval number: 08, date: 18.04.2023).

Informed Consent: This study was designed as a retrospective analysis based on anonymized patient records. Due to the retrospective nature of the study, informed consent was not required.

Footnotes

Authorship Contributions

Surgical and Medical Practices: Ö.T., S.K., A.Y., Concept: Ö.T., S.K., Design: Ö.T., S.K., Data Collection and/or Processing: Ö.T., Analysis and/or Interpretation: Ö.T., Literature Search: Ö.T., S.K., A.Y., Writing: Ö.T., A.Y.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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