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The Role of Impacted Third Molars in Mandibular Angle Fractures: Findings from Trauma-Related Panoramic Radiographs

Nasim Esmaeeli [1], Farzaneh Mosavat [2*], Farnoosh Razmara [3], Ahura Ahmadi [4]

1. School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.

2. Department of Oral & Maxillofacial Radiology, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran; Craniomaxillofacial Research Center, Tehran University of Medical Sciences, Tehran, Iran.

3. Department of Oral and Maxillofacial Surgery, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran; Craniomaxillofacial Research Center, Tehran University of Medical Sciences, Tehran, Iran.

4. Community Medicine Specialist, Craniomaxillofacial Research Center, Tehran University of Medical Sciences, Tehran, Iran.

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**Corresponding author:*
Farzaneh Mosavat

Department of Oral & Maxillofacial Radiology, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran; Craniomaxillofacial Research Center, Tehran University of Medical Sciences, Tehran, Iran.

Tel: +98-913-3221923
Fax: +98-21-84903747
Email: mosavat@sina.tums.ac.ir

ABSTRACT

Introduction: Mandibular angle and condylar fractures are highly prevalent maxillofacial injuries. The presence of impacted third molars may influence fracture patterns by weakening mandibular biomechanics, though the literature remains controversial. Deeper impactions, angulation, and root morphology have been variably associated with fracture risk. This study aims to investigate the effect of the presence of impacted third molars and their characteristics on mandibular fracture.

Materials and Methods: Panoramic images of 300 patients with mandibular fractures were examined. The presence of impacted third molars, position, angle, number of roots, and distance from the inferior border of the mandible were considered as independent variables, while the location of the fracture was considered as the dependent variable.

Results: The presence of impacted third molars increased mandibular angle fracture odds by 11.15-fold but decreased condylar fracture odds by 0.28-fold. Class B and Class 3 impactions had higher angle fracture odds compared to Class A and Class 1, respectively. Distoangular or horizontal molars increased angle fracture odds 5.09 and 4.22. The odds of angle fracture in mandibular quadrants with a single conical root third molar and in those with a tooth bud without root formation were 2.60 and 3.32 times higher. Conversely, Class C impactions decreased condylar fracture odds.

Conclusion: The existence of impacted third molars, along with a deeper impaction within the mandibular bone and a closer proximity to the inferior border of the mandible, heightens the probability of mandibular angle fracture while diminishing the occurrence of mandibular condyle fracture. Furthermore, in cases where third molars possess a single conical root and are positioned distoangularly or horizontally, the risk of mandibular angle fracture is elevated.

Keywords: Mandibular fracture; Impacted mandibular third molar; Mandibular angle.

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Introduction

Mandibular bone fracture is among the most prevalent fractures in the maxillofacial region [1], accounting for approximately 40 to 65 percent of facial fractures [2], potentially due to its mobility or relatively low skeletal support [3]. Factors influencing the occurrence of these fractures include the direction, magnitude, and nature of the applied force, as well as mandibular biomechanical properties such as bone density and mass, anatomical or pathological weakening bone structures, and the presence of teeth [4]. Nowadays, with the increasing incidence of traumas resulting from motor vehicle accidents, falls, sports injuries, and conflicts, the prevalence of mandibular fractures has risen [5].

Fractures in the mandibular angle region are quite prevalent, comprising about 25 to 33 percent of all mandibular fractures [3,5], potentially due to the unique anatomical position of the angle. The angle lies in a transitional zone from dentate to edentulous areas and from the horizontal to the vertical body regions, where the trajectory of the mandibular trabeculae changes. Additionally, the angle and ramus are influenced by the significant forces exerted by the masticatory muscles [7]. Conversely, condylar fractures also exhibit a high prevalence among mandibular fractures [1]. The condyle represents the weakest region of the mandible, and if the force transmitted to the angle is fully absorbed, the odds of condylar fracture decrease [8]. Panoramic radiography is a suitable imaging method for displaying the entire mandible and condylar region and is used as an ideal diagnostic tool for screening mandibular fractures. Studies have shown that its sensitivity in diagnosing condylar fractures is approximately 70 to 90 percent [9]. Several retrospective studies have reported that the presence of impacted third molars in the mandible may influence the risk of fractures in various mandibular regions [10-17]. These studies indicate that the presence of impacted third molars may increase the risk of angle fractures while potentially reducing the risk of condylar fractures. It appears that the position and degree of impaction of the third molars may also affect the risk of fractures [18]. Some believe that deeper impaction increases the risk of angle fractures [7]. Conversely, some have stated that with an increase in impaction depth, the risk of mandibular angle fractures decreases [6]. Some have also shown that in fractures resulting from sports traumas, an increase in the degree of impaction of the third molars leads to a higher incidence of angle fractures [16]. Additionally, a significant association between the presence of a single conical-rooted third molar and angle fractures has been reported [2]. Believing that prophylactic removal of impacted third molars in high-risk individuals, such as athletes in martial arts, can reduce the risk of mandibular angle fractures [7]. On the other hand, some believe that due to the difficulties of surgical fixation of condyles compared to angle surgeries, it is better not to extract impacted molars to reduce the risk of condylar fractures [8]. Nevertheless, the relationship between mandibular fracture and the presence of impacted third molars remains uncertain [1], necessitating further studies with larger sample sizes. Additionally, there are few quantitative studies investigating the association between third molars and fractures in other parts of the mandible [6]. Therefore, today, studies on the relationship between the presence of impacted third molars and mandibular fractures have received more attention [19]. This study aimed to investigate the relationship between mandibular fracture and the existence of impacted third molars, to determine the influential factor in decision-making regarding early extraction of impacted third molars in high-risk groups.

Materials and Methods

In this cross-sectional study, panoramic radiographs of patients with mandibular fractures referred to the Department of Oral and Maxillofacial Surgery at Shariati Hospital, Tehran, for 5 years consequently, were examined. The sampling method was Convenient, and only patients over 16 years of age with proper quality panoramic images were included in the study. The exclusion criteria were: iatrogenic fractures during third molar extraction, pathological fractures caused by cysts or tumors in the posterior mandibular region, or edentulous patients. The study was conducted in compliance with the ethical principles outlined in Tehran University of Medical Sciences IR.TUMS.DENTISTRY.REC.1397.106.

Patient information such as age, gender, presence or absence of impacted third molars, right or left side, number of roots, eruption status, impaction angle, distance from the inferior border of the mandible, and mandibular fracture were recorded using data tables based on patients' records and panoramic radiographs. Third molars were categorized into three groups based on the number of roots: germinal without root formation, conical-rooted, and multi-rooted. The eruption status of the third molars was also determined according to the Pell and Gregory classification. This classification categorized the horizontal position of third molar relative to the ramus into three classes [1,2,3] and

the vertical position relative to the occlusal surface of the second molar into three classes (A, B, C). In Class 1, the distance between the ramus and the distal surface of the second molar is sufficient for the third molar, in Class 2, this distance is less than the mesiodistal width of the third molar, and in Class 3, the entire third molar or most of it is located in the ramus. The occlusal surface of the third molar in Class A is at the same level or higher than the occlusal surface of the second molar, in Class B it is between the cementoenamel junction (CEJ) and the occlusal surface of the second molar, and in Class C it is lower than the CEJ of the second molar. Impacted third molars in any situation other than Class 1A according to the Pell and Gregory system were defined as impacted. Additionally, based on the Winter classification, third molars were divided into four categories: mesioangular, distoangular, vertical, and horizontal. The Shiller method was used to define this classification (Figure 1).

Specifically, if the slope of the occlusal surface of the third molar relative to the occlusal surface of the second molar is 0±10°, it is considered vertical; ±11-70°, mesioangular or distoangular; and if it is greater than ±71°, it is considered horizontal. The distance from the inferior border of the mandible was divided into two groups for the third molars: α, which the distance from the lowest point of the third molar to the mandibular border is equal to or greater than the same distance for the second molar and β, where this distance was less than the distance for the second molar (Figure 2). Mandibular angle fractures were described as follows: any fracture posterior to the second molar that starts from the intersection of the ramus and the mandibular body in the retromolar region and ends at the mandibular angle resulting from the intersection of the inferior border of the mandibular body and the posterior border of the ramus. Condylar fractures were defined as a fracture line above the sigmoid notch.

Symphyseal fractures were considered in the midline region and parasymphyseal fractures up to the canine on each side. Body fractures extended from the distal of the canine to the angle region, and ramus fractures were considered between the angle and condyle regions. The severity of the trauma was also classified based on the number of fractures present in the jaw. One fracture was considered low severity, two fractures were considered moderate, and three or more fractures were considered high severity. The data was recorded by a final-year dental student under a maxillofacial radiologist's supervision with more than ten years' experience.

Results

In this study, panoramic images of 300 patients who had mandibular fractures were examined. Out of this number, 150 patients had impacted third molars on the side of the fracture, while the other 150 patients either had fully erupted third molars or were missing third molars on the side of the fracture. The mean age of the patients was 27.67 ± 8.75 years. There were 247 male patients (82.3%) and 53 female patients (17.7%). In terms of the frequency of trauma types, there were 178 cases resulting from motor vehicle accidents (59.3%), 50 cases of physical altercations (16.7%), 30 sports-related injuries cases (10.0%), and 42 cases from falls (14.0%). In general, among the 300 patients with mandibular fractures, there were a total of 520 fractures, with 127 patients having one fracture (42.3%), 144 patients having two fractures (48.0%), and 29 patients having three or more fractures (9.7%).

Among 600 mandibular quadrants, fractures were observed in 135 at the angle (22.5%), 122 at the body (20.3%), 108 at the condyle (18.0%), 103 at the parasymphyseal region (17.2%), and 52 (8.7%) at other sites (including the ramus, symphysis, and coronoid). In quadrants with impacted third molars, 208 quadrants exhibited fractures (80.6%), while 50 quadrants showed no fractures (19.4%). In quadrants without impacted third molars, 241 quadrants had fractures (70.5%), while 101 quadrants showed no fractures (29.5%). Overall, 151 quadrants were fracture-free, while the majority of these cases did not have impacted third molars. Among various fracture locations, the presence of fractures at the angle and condyle differed significantly depending on the presence or absence of impacted third molars (Table 1).

In the mandibular quadrant with condylar fractures, among those with low trauma severity, 103 had impacted third molars (42.9%), while 17 did not (5.8%). Similarly, in cases of moderate trauma severity, 11 had impacted third molars (61.1%), while 4 did not (8.2%). The frequency of fractures in mandible, angle and condyle, based on their position according to the Pell and Gregory and Shiller classification and number of third molar roots and distance between wisdom tooth and the inferior border of the mandible can be seen in Table 2. Data analysis showed that in individuals with mandibular fractures, the chance of fracture in quadrant with impacted third molar teeth has significantly increased (P = 0.008, OR = 1.55; 95%CI: 1.12-2.15). Additionally, in individuals with mandibular fractures, the chance of mandibular angle fracture in quadrants

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with impacted third molar teeth was significantly higher (P < 0.001, OR = 11.17; 95%CI: 6.99-17.85). Multivariable analysis of the relationship between age, gender, impacted wisdom tooth, trauma severity, and unilateral or bilateral fracture with mandibular angle fracture showed that among these variables, impacted wisdom tooth and bilateral fracture had a significant and independent association with mandibular angle fracture (Table 3). Specifically, the presence of impacted third molar increased the odds of angle fracture by 11.15 times (OR = 11.15; 95%CI: 6.64-18.73), and bilateral fracture increased the chance of angle fracture by 1.53 times (OR = 1.53; 95%CI: 1.06-2.23). In individuals with mandibular fractures, the odds of condylar fracture in the quadrant with impacted third molars were significantly reduced (P < 0.001, OR = 0.26; 95%CI: 0.15-0.44).

Multivariable analysis of the relationship between age, gender, impacted third molar, trauma severity, and unilateral or bilateral mandibular condylar fracture (Table 4) revealed that all these variables, except gender, had a significant and independent association with condylar fracture. Specifically, the presence of impacted third molars reduced the odds of condylar fracture by 0.28 times (OR = 0.28; 95%CI: 0.15-0.52), moderate trauma severity compared to low severity increased the odds of condylar fracture by 14.18 times (OR=14.18; 95%CI: 7.71-26.08), bilateral fracture increased the odds of condylar fracture by 3.7 times. (OR = 3.70; 95%CI: 2.20-6.20), and increasing age increased the odds of condylar fracture by 1.03 times (OR = 1.03; 95%CI: 1.00-1.06). The odds of parasymphysis fracture in the quadrant with impacted third molars significantly decreased (P = 0.019, OR = 0.61; 95%CI: 0.40-0.92).

Multivariable analysis showed that, impacted third molar presence, trauma severity, and bilateral fracture had significant and independent associations with parasymphysis fracture. Specifically, the presence of impacted third molars reduced the odds of parasymphysis fracture to 0.57 times (OR = 0.57; 95%CI: 0.36-0.91), moderate trauma severity increased the odds of parasymphysis fracture to 5.76 times compared to mild trauma severity (OR = 5.76; 95%CI: 3.12-10.63), and bilateral fractures increased the odds of parasymphysis fracture to 2.54 times compared to unilateral fractures (OR = 2.54; 95%CI: 1.64-3.92). Fractures in other regions such as the body, coronoid, ramus, and symphysis did not show a significant association with the presence of impacted third molars or with age, gender, trauma severity, or bilateral fractures. The only significant association found was between trauma severity and ramus fracture (P = 0.001), where moderate trauma severity increased the odds of ramus fracture to 5.93 times compared to mild trauma severity (OR = 5.93; 95%CI: 1.99-17.65). The relationship between mandibular angle and condyle fracture and third molar characteristics has been demonstrated in Table 5, according to the findings horizontal position of the third molar, as well as the chance of having a fracture in the angle in class 2 and 3 was significantly calculated 4.68 and 9.66 times higher than class 1, respectively. Moreover, the odds of having a fracture in the angle in the mandibular quadrants with third molars in group β were significantly calculated as 11.78 times higher than the third molars in group α.

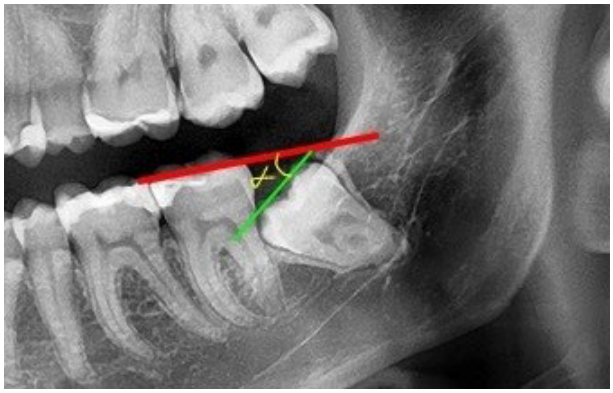

Figure 1. The Shiller method for classifying the angle of mandibular third molars.

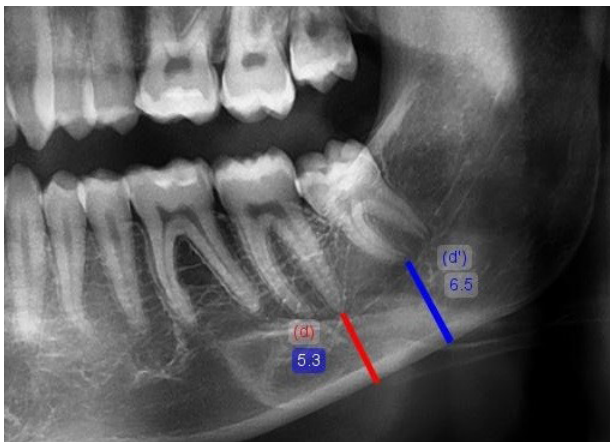

Figure 2. Comparison of the minimum distance from the third molar to the mandibular border (d') relative to this distance for the second molar (d).

Table 1. The distribution of mandibular fracture location based on the presence of impacted third molars.

Location of the Fracture													
Coronoid		Ramus		Parasymphysis		Body		Condyle		Angle			
Present	Absent	Present	Absent	Present	Absent	Present	Absent	Present	Absent	Present	Absent		
5 (1.5%)	337 (98.5%)	12 (3.5%)	12 (3.5%)	69 (20.2%)	273 (79.8%)	78 (22.8%)	264 (77.2%)	87 (25.4%)	255 (74.6%)	21 (6.1%)	321 (93.9%)	Absent	Impacted Third Molar
0	258 (100%)	5 (1.9%)	253 (98.1%)	34 (13.2%)	224 (86.8%)	44 (17.1%)	214 (82.9%)	21 (8.1%)	237 (91.9%)	114 (44.2%)	144 (55.8%)	Present	

Table 2. The frequency of mandibular fractures regarding the position of third molar teeth, number of roots and distance from the inferior border of the mandible.

Condyle Fracture		Angle Fracture		Total Mandibular Fracture			
Absent	Present	Absent	Present	Absent	Present		
127 (77.9%)	36 (22.1%)	157 (96.3%)	6 (3.7%)	53 (32.5%)	110 (67.5%)	Absence of Third Molar	
195 (77.4%)	57 (22.6%)	209 (82.9%)	43 (17.1%)	65 (25.8%)	187 (74.2%)	A	Vertical Position of Third Molar
47 (90.4%)	5 (9.6%)	26 (50%)	26 (50%)	9 (17.3%)	43 (82.7%)	B	
123 (92.5%)	10 (7.5%)	73 (54.9)	60 (45.1%)	24 (18.0%)	109 (82.0%)	C	
163 (74.8%)	55 (25.2%)	189 (86.7%)	29 (13.3%)	55 (25.2%)	163 (74.8%)	1	Horizontal Position of Third Molar
179 (92.3%)	15 (7.7%)	110 (56.7%)	84 (43.3%)	41 (21.1%)	153 (78.9%)	2	
23 (92%)	2 (8%)	9 (36%)	16 (64%)	2 (8%)	23 (92%)	3	
97 (93.3%)	7 (6.7%)	62 (59.6%)	42 (40.4%)	22 (21.2%)	82 (78.8%)	Mesioangular	Angle of Third Molar
11 (91.7%)	1 (8.3%)	5 (41.7%)	7 (58.3%)	0	12 (100%)	Distoangular	
28 (93.3%)	2 (6.7%)	13 (43.3%)	17 (56.7%)	4 (13.3%)	26 (86.7%)	Horizontal	
225 (78.1%)	63 (21.9%)	226 (78.5%)	62 (21.5%)	70 (24.3%)	218 (75.7%)	Vertical	
110 (8.6%)	17 (13.4%)	72 (56.7%)	55 (43.3%)	16 (12.6%)	111 (87.4%)	conical-rooted	Number of third molar roots
32 (88.9%)	4 (11.1%)	19 (52.8%)	17 (47.2%)	7 (19.4%)	29 (80.6%)	germinal without root formation	
221 (81.0%)	52 (19.0%)	216 (79.1%)	57 (20.9%)	74 (27.1%)	199 (72.9%)	multi-rooted	
240 (79.5%)	62 (20.5%)	264 (87.4%)	38 (12.6%)	83 (27.5%)	219 (72.5%)	α	Third molar distance from the inferior border of the mandible
127 (93.4%)	9 (6.6%)	46 (33.8%)	90 (66.2%)	17 (12.5%)	119 (87.5%)	β	

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Table 3. Multivariable analysis of the relationship between selected variables with mandibular angle fracture.

Mandibular Angle Fracture				
P-value	95% confidence interval	Odds ratio		
0.001>	18.73-6.64	11.15	Present	Impacted third molar
		1	Absent	
0.02	2.23-1.06	1.53	Bilateral	Fracture side
		1	Unilateral	
0.65	1.49-0.53	0.89	Male	Gender
		0	Female	
0.46	2.62-0.65	1.30	Moderate	Severity of trauma
		1	Mild	
0.91	1.02-0.97	1.00	Age (years)	

Table 4. Multivariable analysis of the relationship between selected variables with mandibular condyle fracture.

Mandibular Condyle Fracture				
P-value	95% confidence interval	Odds ratio		
0.001>	0.52-0.15	0.28	Present	Impacted third molar
		1	Absent	
0.001>	6.20-2.20	3.70	Bilateral	Fracture side
		1	Unilateral	
0.14	1.17-0.34	0.63	Male	Gender
		1	Female	
0.001>	26.08-7.71	14.18	Moderate	Severity of trauma
		1	Mild	
0.03	1.06-1.00	1.03	Age (years)	

Table 5. The relationship between fractures of the mandibular angle and condyle and the attributes of the third molar.

P-value	95% confidence interval	Odds ratio			
0.001>	5.87-2.040	3.76	C	Vertical Position of Third Molar	Mandibular Angle Fracture
0.001>	7.28-2.68	4.42	B		
		1	A		
0.001>	24.20-3.85	9.66	3	Horizontal Position of Third Molar	
0.001>	7.21-1.56	4.68	2		
		1	1		
0.001>	3.72-1.56	2.41	Mesioangle	Angle of Third Molar	
0.02	19.54-1.33	5.09	Distoangle		
0.001	9.89-1.80	4.22	Horizontal		
		1	Vertical		
0.001>	4.00-1.69	2.60	conical-rooted	Number of third molar roots	
0.001>	6.25-1.77	3.32	germinal without root formation		
		1	multi-rooted		
0.001>	18.54-7.49	11.78	β	Third molar distance from the inferior border of the	
		1	α		

P-value	95% confidence interval	Odds ratio			
0.002	0.62-0.13	0.29	C	Vertical Position of Third Molar	Mandibular Condyle Fracture
0.05	1.00-0.17	0.41	B		
		1	A		
0.15	1.68-0.04	0.25	3	Horizontal Position of Third Molar	
0.001>	0.48-0.13	0.25	2		
		1	1		
0.001	0.59-0.13	0.28	Mesioangle	Angle of Third Molar	
0.24	2.56-0.02	0.25	Distoangle		
0.14	1.64-0.03	0.22	Horizontal		
		1	Vertical		
0.14	1.17-0.32	0.61	conical-rooted	Number of third molar roots	
0.17	1.37-0.17	0.49	germinal without root formation		
			multi-rooted		
0.002	7.06-1.57	3.33	β	Third molar distance from the inferior border of the	
			α		

Discussion

Various studies have investigated the relationship between the presence of impacted third molars in the mandible and the odds of mandibular angle fracture. Tevepaugh and Fuselier's studies, respectively, demonstrated that patients with impacted mandibular third molars have 3.8 and 2.1 times higher odds of suffering from angle fractures [3,7]. Their findings regarding the methodology and increased odds of angle fracture in the presence of third molars were similar to present study. Specifically, in this research, 44.2% of mandibular quadrant with impacted third molars had angle fractures, with the odds of angle fracture being 11.17 times higher in these cases compared to quadrants without impacted third molars. It can be concluded that the presence of impacted third molars, due to occupying a portion of the mandibular bone, can lead to the loss of integrity in the angle region and consequently predispose it to fracture [14].

In Iida et al.'s study, angle fractures were more prevalent in the group with impacted third molars in all trauma causes except for automobile accidents [20]. In this regard, current research did not show a significant difference between various types of trauma, with angle fractures resulting mainly from car accidents comprising the majority of the samples. In the context of the vertical position of the third molar and angle fracture, Fuselier et al.'s study demonstrated a significant association between the occlusal position of the third molar and the likelihood of angle fracture, while an increased impaction depth leading to a higher risk of angle fracture [7]. This finding aligns within present study, where the odds of angle fracture in Classes B and C were 4.42 and 3.76 times higher, respectively, compared to Class A. Similarly, Samiei Rad et al. found the highest odds of angle fracture in Class B, indicating that increased vertical impaction of the third molar further weakens the angle region [19]. Mandibular angle fractures exhibit tension along the superior border and compression along the inferior border, as evidenced by the placement of muscle insertions, muscle force, and bite force on both sides of the fracture. Disruption of the cortical bridge of the superior border by impacted third molars creates an inherent weakness in the mandibular angle.

This weakened state renders the angle more susceptible to fractures, requiring less force and muscle tension for occurrence. Consequently, the highest incidence of angle fractures is observed in cases where impacted molars are positioned in Class B, where the superior border is interrupted, rather than in Class C positions where the superior border remains intact [18]. Some studies indicated that the vertical position of the third molar does not significantly alter the risk of angle fracture [3,21], a different finding to current research, which could be attributed to the limited sample size of these studies. Similarly, Iida et al. found no significant relationship between the vertical position of the third molar and angle fracture, possibly due to their analysis being restricted to fully erupted third molars and lacking comparison with Class A [20]. Furthermore, a previous study noted no significant difference in severe

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trauma-induced fractures [18]; meanwhile, our study had insufficient cases of severe trauma-induced fractures to yield statistically significant results. Regarding the association between the horizontal position of the third molar and mandibular angle fracture, in the study by Duan et al., the highest incidence of angle fracture was observed in Class 2 and 3 positions [18], which aligns with present study's findings. Both Duan and Samiei Rad found that Class 2 impaction was the most common type of impaction in the group with angle fractures [18,19]. However, as part of this study, the highest odds of angle fracture was observed in Class 3. Tevepaugh, Iida, and Fuselier found no significant relationship between the horizontal position of the third molar based on the Pell and Gregory classification and angle fracture [3,7,20], which contrasts with present study findings, possibly due to the analysis being limited to fully erupted third molars and not comparing with Class 1 in Iida's study.

The study by Fuselier et al. demonstrated a significant association between the angulation of the third molar and the likelihood of angle fracture [7], which was similar to current research. Thangavelu's study also indicated a significant relationship, with the highest incidence of angle fracture observed in mesioangular angulation [8] Furthermore, Barman et al. reported that among 79 mandibular angle fracture cases, 44 (55.7%) were associated with mesioangular impacted third molars, all of which caused horizontal unfavourable fractures [22]. However, in present study, the highest likelihood of angle fracture was found in distoangular and horizontal angulations. This finding can be justified by the increased impaction in the region of the angle in distoangular and horizontal angulations, leading to greater interference with the external oblique ridge (which plays a role in the strength of the angle region) and consequently weakening this area. The study by Iida was the first to report that the presence of semi-impacted mandibular third molars could reduce the risk of condylar fracture [20], which was consistent with current study's findings. Other studies also corroborated this aspect with our study [4,8, 18,19,23]. In the absence of impacted third molars, the condylar region is considered the weakest area of the mandible. However, with the presence of impacted third molars, the angle region is weakened, resulting in an increased chance of fracture in the angle region before force impacting the condyle, thus reducing condylar fracture [18]. In a previous study by Antic, the highest chance of condylar fracture was observed in the absence of impacted third molars and in class A1 [24], which was consistent with the results demonstrated in current research. As mentioned, in this case, the structural integrity of the angle is preserved, and the condyle remains a weak point of the mandible. In Antic's study, the vertical and distoangular angles of the third molar showed the highest and lowest chances of condylar fracture, respectively, although this relationship was not significant [24]. In the current study, the results were consistent with this pattern. Najipour's study also did not show a significant relationship between condylar fracture and the angle of impacted third molars [4], which may be due to the lower number of condylar fractures compared to angle fractures in these studies, resulting in a lack of significant correlation.

A few studies examined the effect of the number of roots of impacted third molars on mandibular fractures [1,24]. In the study by Antic et al., the highest significant occurrence of mandibular fracture was observed in the group with single or fused cone-shaped roots [24]. Similarly, in our study, the chance of mandibular fracture was significantly higher in the group with single cone-shaped roots and germinal buds without root formation. This relationship can be justified by the wedge-like effect of the conical root when force is applied, leading to force concentration at a single point, whereas a multi-rooted tooth can distribute force more evenly and preserve bone between the roots. Additionally, the follicular space occupied by the dental germinal bud may lead to bone integrity loss and weakening of the angle region. In our study, the chance of condylar fracture did not show a significant difference in terms of the number of roots.

In the study by Antic et al. [24], the relationship between the distance of the third molar to the inferior border of the mandible and mandibular fracture was investigated for the first time. Similar to the current study, it was found that the probability of angle fractures was significantly higher in the β group compared to the α group. This can be justified by the narrowing of the bone width of the mandible in this region due to the decrease in the distance from the third molar to the inferior border of the mandible, resulting in greater weakening [25,22]. The probability of condylar fractures was significantly higher in the α group compared to the β group. The studies by Gaddipati [23] et al, Ansari and colleagues [26] demonstrated that the risk of condylar fracture with a fracture on the opposite side of the mandible is higher. Similarly, in the current study, it was observed that in bilateral mandibular fractures, the probability of one of the fractures being a condylar, angle, or parasymphyseal fracture is significantly

higher. Furthermore, the fracture in the parasymphyseal region showed a significant association with the presence of impacted third molars, indicating that in the presence of impacted third molars, the risk of parasymphyseal fracture decreases. Study limitation: Since the direction of trauma is likely to be influential in the location of fractures, our study also aimed to record this information; however, due to the lack of such data in the patients' records, we were unable to document it. Additionally, all hospitalized patients at that time (especially those involved in accidents, who constituted a considerable portion of our sample) were unable to recall the direction of the trauma. This limitation could potentially confound the results of this study. Furthermore, due to the two-dimensional nature of panoramic images and the unavailability of PA skull images in the hospital system for all patients, it was not possible to reliably determine the desirability or undesirability of each fracture.

Conclusion

The presence of impacted third molars, increased impaction depth within the mandibular bone, decreased distance from the inferior border of the mandible, having a single conical root, and a distoangular or horizontal angle increase the odds of fractures in the mandibular angle. Conversely, the presence of impacted third molars, increased impaction depth, and decreased distance from the inferior border of the mandible reduce the odds of fractures in the condyle. However, no significant relationship was observed with the number of roots and the angle of the third molar. With increasing age, intensity of trauma, and occurrence of bilateral fractures, the odds of condylar fractures increased. Conversely, only with bilateral fracture occurrence, the odds of fractures in the angle increased.

Recommendations

Conducting cohort studies in populations with third molars and following these individuals over time would allow for comparison with individuals who do not experience fractures. This longitudinal approach could provide a more precise understanding of the risk of mandibular fractures. Alternatively, finite element studies could be conducted on human mandibular specimens to calculate the force required for fracture. These studies could offer valuable insights into the biomechanics of mandibular fractures and help refine our understanding of fracture risk factors.

Conflict of Interest

There is no conflict of interest to declare.

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