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Association Between Lower Third Molars Impaction and Mandibular Angular Fractures: A prospective Cohort Study in Major Hospitals in Sana'a City.

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Abstract

Background and objective: Mandibular angle fractures are among the most common facial injuries and are often associated with impacted third molars (ITMs). While several studies have suggested a link between impacted mandibular third molars and the likelihood of mandibular angle fractures, the nature and strength of this relationship remain inconclusive, particularly in Yemen. Therefore, this study aimed to investigate the relationship between impacted mandibular third molars and mandibular angle fractures in Yemeni patients attending major hospitals in Sana'a City, Yemen.

Methods: A prospective case-control study included 52 patients with impacted mandibular third molars. They were divided into two equal groups: Group A included patients with mandibular angle fractures who had sustained trauma and were referred to the oral and maxillofacial surgery department of selected hospitals. Group B included patients without mandibular angle fractures who had sustained trauma and were referred to the oral and maxillofacial surgery departments of the selected hospitals. Data were collected through clinical and radiographic examinations, orthopantomograms, cone beam computed tomography (CBCT), and written questionnaires. The condition of the mandibular third molars was assessed according to the Bell, Gregory, and Winter classification systems. Data were analyzed using chi-square tests, proportional hazards, and logistic regression to assess the association between impacted third molars and angle fractures using the SPSS program (Version. 26).

Results: Impacted lower third molars were present in 50% of the fracture cases and 42.3% of the controls, with a calculated RR of 1.18, indicating a slight but non-significant increase in the fracture risk. Missing third molars were significantly associated with mandibular angle fractures (OR = 2.4; p = 0.004), whereas erupted third molars appeared to have a protective effect (OR = 0.4; p = 0.011). No statistically significant differences were observed between the different impaction classifications.

Conclusion: The results indicated that impacted lower third molars may slightly increase the risk of mandibular angle fractures; however, this association was not statistically significant. In contrast, the absence of third molars was associated with an increased fracture risk, as erupted molars provide structural support. In addition, the limitations of the current study restrict the clinical application of such findings.

Article Info

Keywords:
lower third molar, mandibular angle fracture, Pell and Gregory classification, trauma, Winter classification, Yemen

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INTRODUCTION

Despite being the strongest bone in the facial skeleton, the mandible is more vulnerable to fracture than other facial bones. It has been observed that mandibular fractures (MF) occur at a rate twice as high as other maxillofacial fractures, accounting for approximately 35-65% of cases [1]. The susceptibility of the mandible to fracture can be attributed to various factors, with the most significant being its anatomical characteristics and the corticocancellous framework disrupted by the presence of teeth. Multiple factors influence the patterns of mandibular fractures, including the direction and magnitude of the traumatic force, the presence of soft tissue bulk, and the biomechanical characteristics of the mandible, such as bone density and mass, as well as anatomical structures that contribute to weak areas [2]. In addition, the mandibular angle is located in a transitional zone between the dentate body and the lateral flare of the ramus, where a change in the direction of the grain pattern reduces its resistance to fracture compared to other sites of the mandible, thereby increasing the risk of fracture. Since then, the literature has been flooded with research evidence linking the occurrence of mandibular angle fractures to the presence or absence of an impacted third molar [3–5]. Despite extensive research on this subject, the influence of impacted mandibular third molars on the occurrence of angle fractures remains unclear. Several studies have reported that the presence of a mandibular third molar contributes to the weakness of the angle region of the mandible and increases the risk of fracture by twofold [1, 6].

Recently, active research has been conducted at the Faculty of Dentistry, Sana'a University, for example, studying the bone density of the maxillary and mandibular teeth in a sample of Yemeni adults with complete natural dentition [7], the association between Streptococcus mutans biofilm formation, dental caries experience, and antibiotic resistance in adult patients [8], and the efficacy of intra-articular butorphanol injections on signs and symptoms of TMJ disorders [9], no single study has investigated the relationship between impacted mandibular third molars and mandibular angle fractures. Oral and maxillofacial injuries are common in Yemen, and mandibular fractures are a significant public health problem. However, there is limited research on the association between lower third molar impaction and mandibular angle fractures in Yemen, which can hinder the development of effective preventive strategies and evidence-based guidelines for managing these injuries. Therefore, this study aimed to investigate the relationship between impacted mandibular third molars and mandibular angle fractures in Yemeni patients attending major hospitals in Sana'a City, Yemen.

METHODS

Study design: A prospective case-control research design.

Ethical Approval: This study was approved by the Ethical Committee at the Faculty of Dentistry- Sana'a University in the Republic of Yemen with a reference number of (OMFS:07/06/2023), ensuring that this study adhered to the ethical standards for research involving human participants. Additionally, official letters requesting permission to conduct the study were sent from the Faculty of Dentistry, Sana'a University, to the targeted hospitals.

The ethical consideration: An ethical approval and informed consent were obtained prior to the inclusion of study participants to ensure the application of this study was in accordance with ethical guidelines.

Informed consent: Participants were provided an informed consent letter in English/Arabic, which contains study information, and assured participants that their personal information would remain confidential and their identity would not be disclosed in any publications or presentations.

Study Area: The study was conducted in the departments of oral and maxillofacial surgery in major hospitals in Sana'a city, including Al-Kuwait Hospital, Military Hospital, Republic Hospital, and Al-Thawra Hospital, where patient follow-up and data collection were done.

Study sample and Population : This study included 52 patients with impaction in the lower third molars in which they divided to two equal groups : Group A, including patients with mandibular angle fractures who exposed to trauma and attended the selected hospitals' oral and maxillofacial surgery departments. The second group (B) included patients without mandibular angle fractures who were exposed to trauma and attended the same hospitals.

Inclusion criteria for group A: Patients aged 16 to 60 years with uni/bilateral mandibular angle fractures, with fully or partially erupted lower third molars; and with fully impacted lower third molars.

Exclusion criteria: Patients with comminuted mandibular fractures, patients with pathogical lesions around impacted lower third molars, with any congenital deformities or syndromes affecting the dentofacial region and patients with bone diseases that may affect the density of bone as Osteoprosis.

Data Collection and Analysis: The data collection for this study involved a combination of clinical examination and radiological imaging using orthopantomogram (OPG) and cone-beam computed tomography (CBCT) views .

Questionnaire-based data collection: A structured questionnaire was used to document and supplement demographic, clinical, and radiographic findings. The demographic information included the patient/participant's

name, age, sex, and contact details. The questionnaire included details about the history of mandibular angle fracture and lower third molar impaction.

Clinical Examination: Clinical examinations were been conducted to assess mandibular angle fractures and lower third molar position. Clinical examination included classification of the type of mandibular fracture and other variables, such as the cause of the fracture and type of treatment.

Radiographic Examination: The radiographic examination involved analyzing OPG and CBCT views to determine the position of the lower third molars. The position of the mandibular third molars was categorized based on their horizontal and vertical positions and their angulation compared to the adjacent second molar according to the Pell and Gregory classification system. The angulation of the mandibular third molars compared to the adjacent second molars was categorized using the Winter classification system.

Study the association: The position of mandibular third molars, the study also investigated the association between lower third molar impaction and mandibular angle fractures. The type of mandibular fracture, location of the fracture on the mandible, and position and angulation of the third molars were recorded. This information was used to analyze the relationship between third molar impaction and mandibular angle fracture.

Statistical analysis: The statistical analysis for this study involved both descriptive and inferential statistics. Descriptive statistics were used to summarize the demographic data, type of mandibular fracture, age group, cause of fracture, and position of the lower third molars. The positions of the lower third molars were classified, and the results were reported as frequencies and percentages. Inferential statistics were used to determine the association between angular mandibular fractures and impacted mandibular third molars.

Data analysis: It was conducted using the **SPSS program** (**Version. 26**).

RESULTS

Demographic and Health Characteristics: All cases and controls were male. In terms of age distribution, the majority of participants in both groups were between 16 and 30 years old, representing 69.2% (n = 18) in each group. Participants aged 31–60 years represented 30.8% (n = 8) in each group.

Regarding health status, most participants were reported to be in normal health, comprising 96.2% (n=25) in the fracture group and 92.3% (n=24) in the comparison group, totaling 94.2% (n=49). Hypertension was observed in one participant (3.8%) in the fracture group, while diabetes was reported in two participants (7.7%) in the comparison group, collectively representing 1.9% and 3.9% of the total sample, respectively (Table 1 **).**

Third molar status distribution: The distribution of third molar status between the fracture and comparison groups revealed notable differences(Table. **2**) In the fracture group, 50.0% of the third molars were impacted, compared to 42.3% in the comparison group. Missing third molars were present in 26.9% of individuals in the fracture group, whereas no missing third molars were observed in the control group (0.0%). In contrast, erupted third molars were significantly more common in the comparison group (57.7%) than in the fracture group (23.1%).

Tooth status distribution: The analysis of tooth status among participants in the fracture group (n=26) revealed that 54.2% (n=13) had impacted teeth, 28.6% (n=6) had erupted teeth, and all individuals with missing teeth (n=7) were classified within the fracture group, representing 100% of that subgroup. Statistical testing indicated a significant association between missing teeth and the likelihood of fracture (OR = 2.4; 95%, CI: 1.68–3.3; P = 0.004). Similarly, erupted teeth were negatively associated with the occurrence of fractures (OR = 0.4; 95% CI: 0.06–0.7; p = 0.011). In contrast, the presence of impacted teeth was not significantly associated with fracture status (OR = 1.2; 95% CI: 0.65–2.13; P = 0.578).

Side of fracture: Table 3 shows the distribution of fracture sides. The majority of fractures occurred on the right side in 15 patients (57.7%) in the total sample, while the left side had 11 patients (42.3%). Statistical analysis revealed no significant association between the fracture side and study groups (^{2} = 0.6, p = 0.433).

Cause of the mandibular fracture: The result of the cause of the mandibular fracture distribution in (Table:3 illustrated that the most common cause was trauma from an accident or injury, affecting 14 patients (53.8%) of the total patients. Other causes included assault or physical violence (11.5%, n=3), falls or tripping incidents (7.7%, n=2), and dental-related injuries or procedures (3.8%, n=1). A notable proportion of cases (23.1%, n=6) were attributed to miscellaneous or unspecified causes (Figure. 11). The association between the cause of fracture and its occurrence was statistically significant (^{2} = 21.31, P < 0.001).

Type of impaction distribution: Among the total sample, full impaction was more prevalent in both groups, fracture and comparision group. However, a slightly higher proportion of fully impacted third molars was observed in the comparison group (92.3%) than in the fracture group (90.9%). Partial impaction was rare overall but was slightly more common in the fracture group (9.1%) than in the comparison group (7.7%) (Table 5)**.** Pell and Gregory classification distribution: The relationship between mandibular angle fractures and the classification of tooth impaction was assessed based on Pell and Gregory's (vertical and horizontal) and Winter's classifications (Table **5,6**). Among the types of vertical impaction,

type B was the most frequently observed classification in both groups, accounting for 61.5% of the fracture group and 54.5% of the comparison group. Type C followed with 30.8% in the fracture group and 36.4% in the comparison group. Type A was the least observed, recorded in 7.7% of the fracture group and 9.1% of the comparison group (Figure. 13). With regard to horizontal position, Class I was the most common, observed in 61.5% of the fracture group and 63.6% of the comparison group. Class II was observed in 38.5% of the fracture group and 36.4% of the comparison group. Class III was not reported in either group.

Winter classification distribution: According to the Winter classification, mesioangular impaction was the most prevalent pattern, seen in 69.2% of the fracture group and 72.7% of the comparison group. In contrast, vertical impaction was less common, observed in 23.1% of cases in the fracture group and 27.3% in the comparison group. Meanwhile, horizontal impaction was the least frequent, appearing in 7.7% of the fracture group and not observed at all in the comparison group (Table **6**).

Relative risk (RR): The relative risk (RR) and 95% confidence intervals for mandibular angle fractures associated with impacted third molars are shown in Table **4**. The RR for mandibular angle fractures associated with impacted third molars was 1.18, indicating that individuals with impacted third molars had a 1.18 times higher risk of mandibular angle fractures than those without impacted third molars (Table. **7**).

Logistic regression: The logistic regression analysis was conducted to adjust for potential confounders (age, health status, tooth status) (Table **8**). Participants in the younger age group had 59.7% higher odds of experiencing mandibular angle fractures than older individuals (OR = 0.403, p = 0.234). Similarly, individuals reporting poorer health had 59.5% higher odds of fracture than those with better health (OR = 0.405, p = 0.351). However, neither age nor health status was significantly associated with fracture occurrence. Tooth status approached marginal significance (B = -0.661, OR = 0.516, p = 0.073), reflecting approximately 48.4% lower odds of fracture in the presence of impacted third molars.

Impact of Impacted Third Molars on Mandibular Angle fractures: The result of comparison between impacted third molars and mandibular angle fractures distribution in Table 6 illustrated that there were no statistically significant differences between impacted third molars and mandibular angle fractures, as the P value was 0.578. However, a higher proportion of non-impacted cases was found among participants without fractures (57.7%) than among those with impactions (42.3%) (Table 9).

Impaction Classifications and Fracture Risk: Impaction classifications (Pell and Gregory, winter) was analyzed to examine their specific effects on fracture risk distribution. Table 8 illustrates that there were no statistically significant differences between the fracture and comparison groups in relation to Pell and Gregory vertical classification (p = 0.942), horizontal classification (p = 0.916), or Winter's classification (p = 0.638) (Table 10).

DISCUSSION

In the current study, all patients were male and aged 16–30 years. According to several studies in Yemen and worldwide, young males are at greater risk of mandibular fracture because of their involvement in activities that increase exposure to trauma [10–13]. This is also consistent with the results of Antic *et al.* .,[14] who reported that most patients with angular fractures in their study were aged 15–25 years and had a 1.7-fold higher relative risk than other age groups. This pattern has also been observed in other contexts and countries, such as Japan [15] the USA [16], India [17], and Canada [18]. In these studies, angle fractures were found to occur more frequently in men than in women, especially among younger individuals. The higher incidence rate among males is attributed to their increased participation in activities that expose them to a greater risk of physical trauma, such as contact sports and fights.

Lower third molar status distribution: The status of the third molars among the participants revealed compelling results. The presence of impacted third molars was relatively balanced between the two groups; however, a significant difference was observed in the presence of erupted and missing third molars. Our study found that missing third molars were exclusively present in the fracture group and were significantly associated with an increased risk of mandibular fracture (OR = 2.4; p = 0.004). All individuals with missing third molars in our sample (n = 7) were classified as the fracture group, representing 26.9% of the cases. In contrast, no missing third molars were observed in the control group. This association suggests that third molar removal may contribute to a weakened mandibular angle, which may increase susceptibility to fractures during trauma. This is supported by a prospective clinical study by Tiwari *et al.*. [19], who reported that the incidence of angular fracture among patients with missing mandibular third molars was 14.45%. Therefore, the removal of the third molar and the resulting weakening of the angular region should be reconsidered.

Side of fracture: Our analysis revealed a slight predominance of right-sided fractures (57.7%) compared to left-sided fractures (42.3%), although this difference did not reach statistical significance (p = 0.433). This finding is not consistent with other contexts; for example, in Korea, a study by Yoon et al. [20] found that 75.8% of unilateral angular fractures were left-sided versus 24.2% right-sided. Similarly, Singh et al. [21] (India) reported 58% of fractures left-sided versus 40% right-sided [21].

This discrepancy between our results and those from other contexts could reflect differences in accident dynamics or sample variance. For example, if road traffic accidents in Yemen more often affect the right side of the jaw (perhaps due to traffic patterns or driving modes), this could lead to a shift in lateralization. However, in the current study, no statistically significant differences were observed between the right and left sides.

Etiology of mandibular fracture: In terms of etiology, the majority of fractures are attributed to accidental trauma, accounting for 53.8% of cases, which is consistent with available studies. Compared to other contexts, this finding is consistent with broader regional and global findings. In the Middle East, traffic accidents are the leading cause of mandibular fractures, as evidenced by studies conducted in Kuwait and other regions, where traffic accidents accounted for 52.1% and 73.85% of cases, respectively [22, 23]. Globally, traffic accidents and assaults are common causes of mandibular fractures, with the mandibular angle frequently affected [24, 25]. This suggests a consistent pattern in the etiology of mandibular fractures across different regions, with some variation in the specific causes and fracture sites. Other causes included assaults, falls, and dental procedures, with a statistically significant association between accidental trauma and fracture incidence. This reinforces the understanding that mandibular fractures are predominantly mechanical in origin and often result from direct impacts. This variability in the etiological factors highlights the multifactorial nature of facial trauma and the importance of taking a comprehensive history during clinical evaluation. The etiological profile of mandibular angular fractures in our study suggests that while third molar status may influence fracture susceptibility to some degree, the cause and direction of the traumatic forces likely play a more dominant role in determining fracture occurrence. This has important implications for prevention strategies and clinical decision making.

Type of impaction and its classification: The use of classification systems such as the Bell, Gregory, and Winter classifications helped further identify the type of impactions present. Type B vertical impaction was the most common in both the fracture (61.5

Several explanations may account for this finding. First, studies have shown that the risk of angle fracture is influenced not only by the depth of impaction but also by the disruption of bone continuity and the position of the third molar relative to the external oblique ridge. Partially impacted teeth (Type B) may disrupt the mandibular stress lines more than fully impacted teeth (Type C), making the angle more susceptible to fracture, even when the tooth is not deeply impacted [26–28]. This may explain why Type B impaction was more common in both groups. Second, compensatory adaptations in the bone structure around different impaction patterns may equalize stress distribution capabilities despite different impaction depths [29]. Regarding horizontal impaction, Grade I horizontal impaction predominated in both the fracture (61.5 %) and control (63.6 %) groups, followed by Grade II. No Class III impaction was observed in either group. The absence of Class III impactions in our sample limited our ability to assess whether more severe horizontal space restrictions influenced the fracture risk. This finding is consistent with other studies; for example, a large study found that Classes I and II were the most common, accounting for 36% and 48%, respectively, and Class III was relatively rare (15%) [30]. However, no significant differences were observed between the fracture and control groups in the vertical or horizontal classifications. This suggests that the relationship between impaction and fracture is not straightforward and may depend on various contextual factors, such as the degree of impaction, surrounding bone density, and individual anatomical differences of the patient. This also suggests that while classification systems are useful for surgical planning, their predictive value regarding fracture risk may be limited. Classifications describing the spatial orientation of molars in the mandible may not fully capture biomechanical vulnerability.

According to the Winter classification, mesial angular impaction was more prevalent in the fracture (69.2 %) and control (72.7 %) groups. However, this prevalence did not significantly affect the fracture risk ($p = 0.638$). This lack of a significant association between the winter classification and fracture status suggests that the angle of impaction may not significantly influence mandibular dysfunction. The prevalence of mesial angular impaction in mandibular third molars is remarkably high, as demonstrated by various studies [31, 32], with rates ranging from 33.3% to 65% in different populations. Despite the high prevalence of mesial angular impaction, studies have indicated no significant association with an increased fracture risk [33]. This lack of association suggests that other factors may play a more important role in the development of mandibular fractures. Collectively, our analyses of impaction classifications suggest that if third molar impaction affects fracture risk, this effect may not depend largely on specific impaction patterns as traditionally classified.

LIMITATION OF THE STUDY

Several limitations of this study must be acknowledged. The relatively small sample size (n = 52 total, 26 in each group) is a limitation of our study, particularly for analyses stratified across multiple impact categories. Limited statistical power may have prevented the detection of smaller effect sizes or more subtle associations between specific impact patterns and fracture risk. The exclusively male composition of our sample, with sex excluded as a confounding variable, limits the generalizability of our findings to women. Sex differences in bone density, mandibular morphology, and trauma exposure patterns may influence the relationship between third

molar status and fracture susceptibility in ways not captured by our analysis. Although our analysis controlled for age and health status as potential confounders, other variables that might influence both third molar status and fracture risk were not comprehensively assessed. These factors include mandibular morphology, bone density, occlusal forces, and specific behavioral risk factors for trauma.

CONCLUSIONS

The results indicated that impacted lower third molars may slightly increase the risk of mandibular angle fractures, but this association was not statistically significant. In contrast, absent third molars were associated with an increased fracture risk, as erupted molars provide structural support. These findings highlight the need to avoid prophylactic third molar removal to prevent fractures. Future studies should include more diverse populations, such as female populations, different age groups, including older adults, and diverse ethnic populations with varying mandibular morphologies.

DATA AVAILABILITY

The accompanying author can provide the empirical data utilized to support the study's conclusions upon request.

A DISPUTE OF INTEREST

There are no conflicts of interest regarding this project.

AUTHOR'S CONTRIBUTIONS

Dr. Ahmed Hameed Ahmed Al-Kassemi: Formal analysis, conceptualization, data organization, and clinical and laboratory examinations to obtain a master's degree in Oral and Maxillofacial Surgery. Prof. Taghreed Ahmed Al-kibsi and Prof. Hassan Abdulwahab Al-Shamahy supervised the work, reviewed the article, and approved the final version.

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Table 1. Demographic characteristics of participants

Variable	Fracture Group	Comparison Group	Total
	N (%)	N (%)	N (%)
Gender	26 Male (100%)	26 Male (100%)	52 Male (100%)
Age group:			
16 to 30	18 (69.2%)	18 (69.2%)	36 (69.2%)
31 to 60	8 (30.8%)	8 (30.8%)	16 (30.8%)
Health Status			
Normal	25 (96.2%)	24 (92.3%)	49 (94.2%)
Hypertension	1 (3.8%)	0 (0.0%)	1 (1.9%)
Diabetes	0 (0.0%)	2 (7.7%)	2 (3.9%)

Table 2. Frequency Distribution– Tooth status

Tooth status	Fracture group		Comparison group		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Impacted	13	50.0%	11	42.3%	24	46.1%
Missing	7	26.9%	0	0.0%	7	13.5%
Erupted	6	23.1%	15	57.7%	21	40.4%
Total	**26**	**100%**	**26**	**100%**	**52**	**100%**

Table 3. Fracture-Specific Variables

Variable	Fracture n=26	OR	95%CI	X^2	P-value
	N (%)				
Tooth status:					
Impacted (n=24)	13 (54.2%)	1.2	0.65 – 2.13	0.3	0.578
Missing (n=7)	7 (100%)	2.4	1.68 - 3.3	8.1	**0.004**
Erupted (n=21)	6 (28.6%)	0.4	0.06 - 0.7	6.5	**0.01**1
Side of Fracture:					
Right	15 (57.7%)	-	-	0.6	0.433
Left	11 (42.3%)				
Cause of fracture:					
Trauma from an accident or injury	14 (53.8%)				
Assault or physical violence	3 (11.5%)	-	-	21.31	< **0.001**
Falling or tripping accident	2 (7.7%)				
Dental-related injury or treatment	1 (3.8%)				
Others	6 (23.1%)				

Table 4. Frequency Distribution– Type of impaction

Type of impaction	Fracture group		Comparison group		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Full	12	92.3%	10	90.9%	22	91.7%
Partial	1	7.7%	1	9.1%	2	8.3%
Total	**13**	**100%**	**11**	**100%**	**24**	**100%**

Table 5. Frequency Distribution– Pell and Gregory classification

Pell and Gregory classification		Fracture group		Comparison group		Total	
		N	%	N	%	N	%
Type	Type A	1	7.7%	1	9.1%	2	8.3%
	Type B	8	61.5%	6	54.5%	14	58.3%
	Type C	4	30.8%	4	36.4%	8	33.3%
	Total	**13**	**100%**	**11**	**100%**	**24**	**100%**
Class	Class I	8	61.5%	7	63.6%	15	62.5%
	Class II	5	38.5%	4	36.4%	9	37.5%
	Class III	0	0.0%	0	0.0%	0	0.0%
	Total	**13**	**100%**	**11**	**100%**	**24**	**100%**

Table 6. Frequency Distribution– Winter classification

Winter classification	Fracture group		Comparison group		Total	
	N	%	N	%	N	%
Vertical	3	23.1%	3	27.3%	6	25.0%
Mesioangular	9	69.2%	8	72.7%	17	70.8%
Horizontal	1	7.7%	0	0.0%	1	4.2%
Total	**13**	**100%**	**11**	**100%**	**24**	**100%**

Table 7. Relative risk (RR) and 95% confidence intervals for mandibular angle fractures associated with impacted third molars

Impacted third molars		Mandibular angle fractures				95% Confidence Interval		
		Yes		No		Lower	Upper	Relative risk
		N	%	N	%			
Impacted	Yes	13	50.0%	11	42.3%	0.5	1.5	1.18
	No	13	50.0%	15	57.7%			

Table 8. Logistic regression to adjust for potential confounders (age, health status, impaction status)

	Mandibular angle fractures					
	B	**S.E.**	**Wald**	**df**	**P-value.**	**OR**
Age	-.909	.764	1.417	1	.234	.403
Health status	-.903	.969	.869	1	.351	.405
Tooth status	-.661	.369	3.220	1	.073	.516
Constant	2.882	1.594	3.267	1	.071	17.85

❉ Regression coefficients (B), standard errors (S.E.), Wald statistics, degrees of freedom (df), p-values, and odds ratiosv(OR).

Table 9. Compare fracture prevalence between impacted and non-impacted groups

Impacted third molars		**Mandibular angle fractures**				**Chi-square**	**P value**
		Yes		**No**			
		N	**%**	**N**	**%**		
Impacted	Yes	13	50.0%	11	42.3%	0.310	0.578
	No	13	50.0%	15	57.7%		

❉ P value Chi-square test, NS= not significant at 0.05 level.

Table 10. Impaction classifications (Pell and Gregory, winter) to examine their specific effects on fracture risk

Pell and Gregory, winter		**Mandibular angle fractures**					
		Yes		**No**		**Chi-square test**	**P value**
		N	**%**	**N**	**%**		
Type	Type A	1	7.7%	1	9.1%		
	Type B	8	61.5%	6	54.5%	0.120	0.942
	Type C	4	30.8%	4	36.4%		
	Class I	8	61.5%	7	63.6%		
Class	Class II	5	38.5%	4	36.4%	0.011	0.916
	Class III	0	0.0%	0	0.0%		
	Vertical	3	23.1%	3	27.3%		
Winter	Mesioangular	9	69.2%	8	72.7%	0.898	0.638
	Horizontal	1	7.7%	0	0.0%		