Original Article - Retrospective Study

Does the Impacted Mandibular Third Molar Increase the Risk of Angle Fracture to Prevent the Incidence of Condylar Fracture? – A Retrospective Analysis

Vaishali Venkatachalam, Rajesh Pandiarajan

Department of Oral and Maxillofacial Surgery, Chettinad Dental College and Research Institute, Chennai, Tamil Nadu, India

Abstract

Introduction: This study aimed to retrospectively analyse the influence of the presence or absence of third molars and its position on the incidence of angle and condylar fractures of mandible. **Methodology:** A retrospective cross-sectional analysis of 148 patients with mandibular fractures was done. A complete analysis of their clinical records and their radiological data was done. The primary predictor variable was the presence or absence of third molars and their positional status (Pell and Gregory's classification) if present. The outcome variable was the type of fracture and other predictor variables included age, gender and fracture aetiology. Data were subjected to statistical analysis. **Results:** We observed that out of 48 patients with angle fractures, third molar was present in 67.34% and in 51.35% of 37 patients with condylar fractures, and there existed a positive correlation between the both. A significant association between the position of the teeth (Class II, III and Position B), angle fractures and (Class I, II, Position A) and condylar fractures was observed. **Conclusion:** Angular fractures were associated with superficial and deep impactions and condylar fractures were associated with superficial impactions. No association was observed with the age, gender or mechanism of injury to the pattern of fractures. Impacted mandibular molars increase the risk of angle fracture, thereby preventing the force transmission to the condyle, and the absence or a fully erupted tooth increases the risk of condylar fractures.

Keywords: Angle, condyle, impacted third molar, trauma

Introduction

The irony of being the strongest but the most common to get fractured in trauma could be observed with the mandible. Among the various factors that explain the susceptibility of the mandible to fracture, the most important ones are the anatomical characteristics and the cortico-cancellous framework that is disrupted by the presence of teeth.[1] The most common sites of fracture are the condyle, angle and parasymphysis. Furthermore, the presence of third molars has been suggested to contribute to increased mandibular fragility because the mandible loses part of its bone structure to harbour tissues that do not contribute to its strength.[2] Furthermore, anatomically, the mandibular angle is at a transition zone from the dentate body to the lateral flare of the ramus[4] and change in direction of the grain pattern reduces its resistance to fracture than the other sites of the mandible and escalates the risk. Although the mechanism of injury and the intensity of force preliminarily determine the type of fracture, the presence and position of third molars contribute secondarily to the fracture pattern. The objective of this study is to explore the influence of the third molars and their positional values on the varying patterns of angle and condylar fractures.

Methodology

A retrospective cross-sectional analysis of 148 patients with mandibular fractures presenting to the Department of Oral and Maxillofacial Surgery of our Institution, Chettinad Dental

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Address for correspondence: Dr. Vaishali Venkatachalam, Department of Oral and Maxillofacial Surgery, Chettinad Dental College and Research Institute, Kelambakkam, Chennai - 603 103, Tamil Nadu, India.
E-mail: vaish712.venkat@gmail.com

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College and Research Institute, from May 2015 to December 2020 was done. All procedures performed in the study were conducted in accordance with the ethical standards given in the 1964 Declaration of Helsinki, as revised in 2013. Patients' consent for utilising their records for any research purposes were obtained before the surgical procedures. After obtaining clearance from the Institutional Review Board and Institutional Human Ethical Board (No: 535/IHEC/19-20), a complete analysis of their clinical records and their radiological data was done. Patients above 18 years of age with isolated angle fractures and isolated condylar fractures were included in the study. Those patients above 15 years of age, presenting with contralateral or bilateral fractures of the angle or condyle, edentulous state, with other associated fractures of the maxilla–mandibular region, presence of tooth germ in relation to mandibular third molar and incomplete records were excluded from the study.

Study variables

The primary predictor variable was the presence or absence of third molars and their positional status if present. The positional status was ascertained by the classification given by Pell and Gregory. The horizontal position was categorised into three classes based on the space available for the eruption of the third molar between the distal part of second molar and the anterior border of ascending ramus and said to be Class I if sufficient space was available, Class II if half of the crown covered by the ramus and Class III if the tooth completely resides within the ramus. The vertical position that depicts the depth component was classified into three: Position A if the highest level of the third molar crown was at the same level of the occlusal plane of the second molar, Position B if it lies between the occlusal plane and the cementoenamel junction of the second molar and Position C if the tooth was positioned below the cervical line of the second molar. Angulation was assessed based on Winter's classification into mesioangular, vertical, horizontal and distoangular. Furthermore, the impaction was classified superficial if it belonged to Pell and Gregory's positional status IA, IB, IIA, IIB and IIIA, and deep in case of IC, IIC, IIIB and IIIC.

The outcome variable of this study was the location of fracture either angle or condylar fracture of the mandible. Based on Kelly and Harrings description, a condylar fracture was diagnosed when the fracture line was at the level of or above the sigmoid notch and an angle fracture was diagnosed if the line ran from a point between the posterior border of the lower second molar and the ramus to a point on the part connecting the lower and posterior margins of the mandible.

Other predictor variables included were age, gender and the mechanism of injury (road traffic accidents, interpersonal violence, falls and others). The medical records of the patients were analysed and demographic details and data pertaining to the diagnosis and management of the injury were recorded. All the radiographs of the patients were retrieved with their ID number from the InstaRISPACS software. Panoramic radiographs were used to determine the presence or absence and position of the impacted third molars. The same along with computed tomography was used to diagnose the fracture pattern of the mandible.

Statistical analysis

The collected data were analysed with IBM SPSS Statistics for Windows, version 23.0. (Armonk, NY, USA: IBM Corp). To describe the data, descriptive statistics, frequency analysis and percentage analysis were used for categorical variables, and the mean and S. D were used for continuous variables. To find the significant difference between the bivariate samples in independent groups, Mann–Whitney U test was used. To find the significance in categorical data, the Chi-square test was used. In both the above statistical tools, the probability value 0.05 is considered a statistically significant level.

Results

Out of 148 mandibular fractures, 74.3% (n = 110) sustained fractures of the angle and the condylar region with varying combinations. About 33% (n = 48) of them sustained isolated fractures of the mandibular angle, 25% (n = 37) isolated condylar fractures, 12% (n = 13) combined fractures of the angle and the condyle, 6.3% (n = 7) bilateral condylar fractures and 3.6% (n = 4) sustained bilateral condylar fractures of the mandible. After excluding the simultaneous and bilateral fractures, 48 angle fractures and 37 condylar fractures were analysed. About 47.9% sustained left angle fractures and 52.1% to the right. About 48.6% was found with left condylar fracture and 51.4% to the right. The most common mechanism of injury was road traffic accident (47.6%; n = 41), followed by interpersonal violence (38.3%; n = 33), falls (10.4%; n = 9) and others. The mean age of the study population was 29.06 ± 9.5 years in the angle fracture group and 31.35 ± 11.7 years in the condylar fracture group [Figure 1]. About 80% of them were male and 20% were female in both groups [Figure 2].

Out of 48 patients with angle fractures, third molar was present on the fracture side in 67.34% (n = 33) of them [Table 1]. The correlation between the presence of third molar and the fracture of the angle bore a high statistical significance with P = 0.007.

In patients with condylar fractures (n = 37), 51.35% (n = 19) were found to have impacted third molar. The correlation between the presence of third molar and the condylar fractures had a high statistical significance with P = 0.007. Furthermore, a high frequency was observed for angular fractures in Pell and Gregory position Class II, Class III and Position B, Position C, and condylar fractures in Class I, Class II and Position A. About 31.3% (n = 15) of those with angle fractures had superficially impacted third molar and 27.1% (n = 13) had deeply impacted third molar, whereas all the 51.4% (n = 19) of those with condylar fractures had superficially impacted third molar which was highly significant statistically with P = 0.002 [Table 2]. No statistical significance was observed between the secondary variables such as age and gender to the type of fracture.

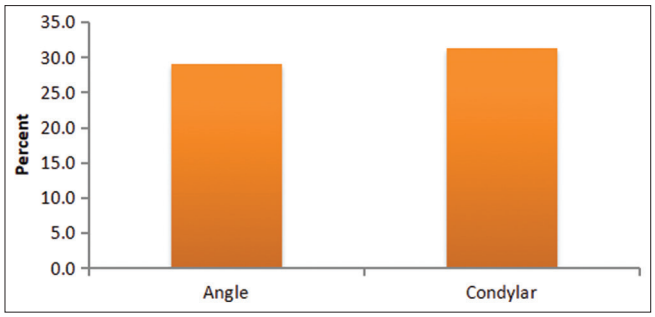

Figure 1: Age distribution in the fracture types

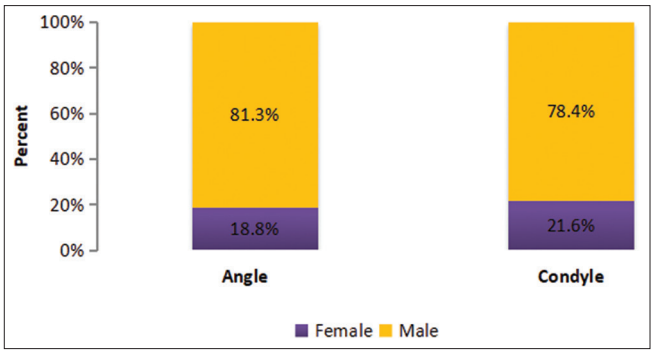

Figure 2: Gender distribution and fracture types

Discussion

The results of our study imply that the presence of impacted third molar and its position has a pivotal role in determining the pattern of fracture and a significant correlation exists between the both. The presence of third molar was observed in about 67% of the population with angle fractures and 51% of those with condylar fractures. Mandibular fractures are the second most common to occur in the facial skeleton and although the strongest, the reason being the intensity, site and direction of the impact, as well as intrinsic factors (bone shape, density, thickness, musculature and presence or absence of teeth).[1] In general, a high-intensity force causes fracture at the point of impact, whereas a low-intensity force dissipates and causes fracture in the regions of the weakness of the mandible. Thus, the condyle and the angle are the most commonly fractured sites in the mandible due to various factors that weaken these both regions.[3] Rudderman *et al*, suggested that muscle insertions and occlusion create an area of tension at the superior border of the mandibular angle (i.e. oblique ridge) and compression at the lower margin of the angular region resulting from the greatest area of positive bending movement.[3] During a traumatic injury, the direction of the sudden spastic pull of the pterygomasseteric sling and the suprahyoid muscles concentrates strain in the angle region. Anatomically, the mandibular angle is at a transition zone from the dentate body to the lateral flare of the ramus[4] and change in direction of the grain pattern reduces its resistance to fracture than the other sites of the mandible and escalates the risk.[3] In addition, teeth in the maxilla and mandible are significant anatomical factors that make the fractures occurring in these bones peculiar from the others. Several authors[4-6] agree to the fact that an impacted third molar, by virtue of the space it occupies, disrupts the cortical continuity and reduces the cross-sectional area of bone in the angle region making it weak and vulnerable to fracture. Reitzik *et al*.[7] from their experimental analysis in monkeys proved that only 60% of the force was required to fracture the angle when a third molar was present. Furthermore, they advocated that when the tooth was absent, an increase in the bony resistance in the region transfers the force to weaker condylar region resulting in its fracture. Bezerra *et al*.[8] from their finite element analysis identified symphysis, retromolar area and condyle bore maximum stresses and the presence of third molar disrupted the pattern of stress propagation. They reported that an impact force on the chin concentrated stress in the external oblique ridge which progressed to the alveolus when a third molar was present. The comparative analysis showed a stress concentration on the vestibular aspect of the mandibular angle when the third molar was present and on the condylar neck when it was absent. Thus, the presence of a mandibular third molar was considered essential to prevent the resultant condylar fractures which could be more complicated and challenging to manage than their angle counterparts.[9] Thus, the results of our study support the aforementioned facts on the increased fracture risk and are in accordance with the results of numerous previous studies depicting the same.

The positional status (horizontal and vertical) of the third molars and their influence on variation in the pattern of fracture when studied portrayed that Pell and Gregory Class II, Class III and Position B, Position C were more associated with angle fractures and Class I, Class II and Position A with condylar. This is in accordance with the results of Al-Harbawee *et al*. who reported that Class II and Position B were associated with angle fractures and Class I with condylar fractures.[2] Similar results were reported by Soós *et al*., Armond *et al*., Duan *et al*., Lee *et al*. and Sohal *et al*., thus emphasising the fact that partially or completely impacted third molars are significantly associated with angle fractures than the condylar fractures while partially and fully erupted third molars are more associated with the condylar fractures.[3,10,12,13,20] Lee *et al*. also suggested that class IIIC and IA exhibited the least association with angle fractures which partially coincides with our results.[13] We observed a minimal association of both in Class IIIC, whereas a noticeable association in the Class IA position. Subashraj *et al*. reported a positive correlation between Class IA position and angle fractures and so did Gadipatty *et al*. and Samierad *et al*.[11,15,16,18] Contrasting results were published by Antic *et al*., where Class IIIC position was significantly associated with the angle fracture.[17] Lida and Hasegawa *et al*. found no positive correlation between the positional status and risk of angle fracture.[4, 19] Similar positive correlations between the Class I, Class II and Position A and condylar fractures were found with the results of Soós *et al*., Armond *et al*., Mehra *et al*., and Duan *et al*.[3,6,12,20] They strongly favour the theory of dynamic energy transmission from angle to condyle in the presence or absence of the third

Table 1: Position of impacted mandibular third molars (Pell and Gregory) in angle and condylar fractures

a. Cross-tabulation of frequency of various positional statuses of impacted mandibular third molars (Pell and Gregory) in angular and condylar fractures

Pell and Gregory's class	Fractures		Total (%)
	Angle (%)	Condylar (%)	
IA	3 (6.3)	6 (16.2)	9 (10.6)
IB	2 (4.2)	4 (10.8)	6 (7.1)
IC	4 (8.3)	0	4 (4.7)
IIA	0	5 (13.5)	5 (5.9)
IIB	4 (8.3)	3 (8.1)	7 (8.2)
IIC	5 (10.4)	0	5 (5.9)
IIIA	5 (10.4)	1 (2.7)	6 (7.1)
IIIB	4 (8.3)	0	4 (4.7)
IIIC	1 (2.1)	0	1 (1.2)
NIL	20 (41.7)	18 (48.6)	38 (44.7)
Total	48 (100.0)	37 (100.0)	85 (100.0)

b. Correlation of the position of the impacted third molar to the angle and condylar fractures

Chi-square tests			
	Value	df	*P*
Pearson Chi-square	22.535[a]	9	0.007
Likelihood ratio	29.771	9	0.000
Number of valid cases	85		

[a]0.007 is Significant

Table 2: Type of impaction versus type of fracture

a. Frequency tabulation of the type of impaction and the type of fracture

Impaction	Groups, count (%)		Total, count (%)
	Angle	Condylar	
Deep	13 (27.1)	0	13 (15.3)
Superficial	15 (31.3)	19 (51.4)	34 (40.0)
Nil	20 (41.7)	18 (48.6)	38 (44.7)
Total	48 (100.0)	37 (100.0)	85 (100.0)

b. Correlation of type of impaction and the type of fracture

Chi-square tests			
	Value	df	*P*
Pearson Chi-square	12.359[a]	2	0.002
Likelihood ratio	17.171	2	0.000
Number of valid cases	85		

[a]0.002 is significant

molar.[2] Revanth *et al*. concluded that a fully erupted third molar resulted in condylar fracture and was in accordance with the other such studies.

In our study, we grouped the impactions into superficial and deep based on the literature of Soós *et al*.[3] and correlated to the fracture pattern. We found that angle fractures were associated with both superficial and deep impactions, whereas interestingly, condylar fractures were associated with superficial impactions only. While Al-Harbawee *et al*.[2] predicted that the risk of angle fracture when an impacted third molar was present with 2.8 fold, Soós *et al*.[3] suggested that deep impactions that were significantly associated with angle fractures had 3.6 times fold risk. The results of our study could be explained based on Meisami *et al*.'s[1] proposition. They tried to explain the increased susceptibility of the angle being fractured in impacted or partially erupted third molar conditions. According to them, when a tooth is completely in occlusion, the widest portion of the tooth is in the mouth and the external oblique ridge remains intact. On the other hand, when the tooth is completely impacted, the widest portion of the tooth is generally found below the external oblique ridge. However, when the tooth is partially impacted, the tension line is disrupted, weakening the mandibular angle and making it more susceptible to fracture. Amaratunga reported that angle fractures occurred in dentate population twice more than edentate ones which indirectly highlights the role of teeth in the propagation of the fracture.[14]

With such varied results, there has not been a general consensus on the prophylactic removal of the third molars in view of the protective effect which the presence of third molars had on the condyle of the mandible and a similar effect which absence had on the angle of the mandible. While Antic *et al*. advocated for the prophylactic removal of third molar, especially in person involving contact sports, Antic *et al*.[17] were against the concept to prevent angle fracture and highlighted that it might result in more serious and complicated condylar fractures. Schwimmer *et al*. and the studies of Lida *et al*., Mehra *et al*. and Subashraj *et al*. were in support of Antic *et al*.[4,6,11,20]

Although the mechanism of injury and the intensity of force preliminarily determine the type of fracture, there is an inevitable role secondarily for the presence and position of third molars in the progression and determination of the fracture pattern.

Conclusion

This retrospective study endorses the direct influence of the presence of mandibular third molar in angle and condylar fractures. We observed that angle fractures were significantly associated with Class II, III and Position B, whereas condylar fractures were associated with Class I, II and Position A. Superficial and deep impactions were correlated with angle fractures and superficial impactions and fully erupted third molars were associated with condylar fractures. Prophylactic removal should be weighed upon before arriving at the decision.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published

and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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