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RESEARCH ARTICLE

EVALUATION OF THE PRESENCE OF MANDIBULAR THIRD MOLARS AS A RISK FACTOR FOR MANDIBULAR ANGLE FRACTURES

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ABSTRACT

Background: Mandibular fractures are influenced by various factors including the direction and impact of force, occlusal loading pattern, and biomechanical factors such as bone density and anatomical structures creating weak areas. Many studies have reported an increased risk of mandibular angle fractures in the presence of the mandibular third molars. However, there have been no formal assessments of this subject and the relationship between fracture risk and the mandibular third molar remains unclear. In this scenario we conducted the present study to evaluate the relationship between the presence of mandibular third molar and risk for angle fracture. **Objectives:** This study was designed toinvestigate the impact of the presence of mandibular third molar and the risk of angle fracture. **Methods:** This is a hospital based case control study. 100 patients who sought treatment in the Department of Oral and Maxillofacial Surgery for mandibular fracture over a period of one year extending from March 2015 to February 2016 were taken. The whole sample was divided in to two groups of 50 patients each.First group (Study group) consisted of patients with mandibular angle fracture. Second group(Control group) consisted of patients with fractures other than angle fracture. Data were collected for the age, sex, mechanism of injury, mandibular fractures, and associated fractures of the facial skeleton and of the mandibular third molars. Using data and panoramic radiographs collected from the patients, the presence of third molars as well as incidence of mandibular angle fractures was determined. All the measurements were recorded in the pre-designed and structured proforma. Statistical analysis of the differences between groups was analyzed with the chi square test. **Results:** A statistically significant relation is present between overall incidence of mandibular angle fractures and the presence of mandibular third molar. In group I, third molars were present in 90% (45/50) of all fractures. In group II, 40% patients had mandibular third molars whereas the remaining 60% were without 3rd molars. These results signifies that the presence of third molar increases the chance of mandibular angle fractures, more so significantly (p=0.001) when it is impacted. **Conclusion:** On the basis of results of the present study, it can be concluded that the risk of angle fractures was higher when the mandibular third molar was present. Mandibular angle fractures are more likely to occur when third molar is impacted or in erupting stages than when it is fully erupted.

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INTRODUCTION

Mandible is the strongest and most rigid component of the facial skeleton. However it is more commonly fractured than other bones of the face, a fact, directly related to its prominent and exposed situation. Fractures of the mandible according to Killey and Rowe comprise between 40–65% of all facial fractures.

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Mandible is the only bone in the face which is mobile and it is prone to fractures for some specific reasons like, it is located in the lower portion of the face, it is an open arch, mechanisms of hyper extension and hyper flexion of the head in accidents. Mandibular fractures occur when excessive local stress is transferred to the mandible. The factors which play an important role in determining the site of fracture in the human mandible includes the osseous anatomy (trabecular pattern), the forces exerted by the muscles of mastication, the occlusal loading pattern, the exact point of application, the direction

and severity of the impacted force, systemic diseases, bony pathologic conditions and the presence of impacted teeth. The bone quality of the mandibular angle is poor and stress is easily concentrated when force is applied to the symphysis or condyle. The term angle is derived from the lateral view of the transition between the horizontal body and the vertical ramus. The angle is a unique anatomic subcomponent of the mandible. It serves as the transition zone between dentate and edentate regions and is commonly associated with impacted teeth. The mandibular angle and ramus are both suspended within the strong masticatory musculature. These qualities may be associated with an increased risk of fracture at the angle region. The teeth are the most important factor determining where fracture occurs. Partially erupted and unerupted wisdom teeth represent lines of relative weakness. Many studies proved that the presence of a mandibular third molar was associated with mandibular angle fractures and could increase the likelihood of fractures. These studies demonstrated that when the M3 was present, the risk of angle fracture increased 2- to 3-fold compared with when the M3 was absent. Based on a recent biomechanical model, it has been suggested that the mandibular third molar decreases the bone mass and cortical continuity in the region of the mandibular angle, weakening the mandibular angle and making it more susceptible to mandibular angle fracture. In this study, we investigated the impact of the presence of mandibular third molar and the risk of angle fracture.

Aim: To assess the influence of mandibular third molars in mandibular angle fractures.

Objectives

- To assess the mandibular fracture patterns.
- To assess the presence of mandibular third molars in mandibular angle fractures.
- To assess the presence of mandibular third molars in fractures other than angle fractures

MATERIALS AND METHODS

The consent form and study protocol were previously approved by the Institutional ethics and research committee, Government Dental College, Kozhikode (IEC no: 52/2014/DCC). Cases were selected from patients who sought treatment in the Dept. of Oral and Maxillofacial surgery for mandibular fractures.

Inclusion Criteria

1. Healthy patients with mandibular fractures.
2. Patients who have given consent for the study.
3. Patients with in the age group of 21- 50 years.

Exclusion Criteria

1. Patients with bony lesions
2. Irradiated patients
3. Edentulous patients
4. Patients who are not consented for the study

A hospital based case control study was carried outin the department of Oral and Maxillofacial Surgery, Govt. Dental College, Calicut. 100 patients who sought treatment in the Department of Oral and Maxillofacial Surgery for mandibular fracture over a period of one year extending from March 2015 to February 2016 were taken. The whole sample was divided in to two groups of 50 patients each. First group (Study group) consisted of patients with mandibular angle fracture. Second group (Control group) consisted of patients with fractures other than angle fracture. Data were collected for the age, sex, mechanism of injury, mandibular fractures, and associated fractures of the facial skeleton and of the mandibular third molars. Using data and panoramic radiographs collected from the patients, the presence of third molars as well as incidence of mandibular angle fractures was determined. Anatomic position of third molar in the mandible was classified using the Pell and Gregory system. Within this system, the highest portion of the M3 crown and its relationship to the second molar determine the vertical level of impaction: Position A indicates the same occlusal level; Position B, between the occlusal surface and the cemento enamel junction (CEJ); and Position C, below the CEJ. The anteroposterior level of impaction of the M3 is determined by the relationship between the second molar and the anterior ascending ramus: Class I indicates adequate space to accommodate the M3 crown; Class II, inadequate space available; and Class III, the majority of the M3 is located within the vertical ramus. Angulation of mandibular third molars was determined using Schiller's method. Using panoramic radiographs inclination of occlusal surface of third molar was measured in relation to the occlusal surface of second molar. Third molars were classified as vertical if they were inclined + 0^o-10^o, mesio angular and distoangular if they were 11-70^o and horizontal if it is more than 71^o. The severity of third molar impaction was assessed using Pederson's difficulty index.All the measurements were recorded in the pre-designed and structured proforma.

Statistical analysis: Data was entered in excel sheet and analysis was done by SPSS software. Statistical analysis of the differences between groups was analyzed with the chi square test.

RESULTS

The present study was conducted on a total of 100 patients divided into two groups of 50 patients. Group I included patients with angle fracture and Group II included patients with fractures other than angle fracture. In both groups presence or absence of third molar was assessed. There was no significant relationship between angle or other fractures and the gender of the patient. In the first group 47 patients were males (94%) and 3 were females (6%). In the second group there were 43 males (86%) and 7 females (14%). Sex variable is statistically insignificant (0.182) in this study (Table 1).

Table 1. Relation between fracture pattern and gender

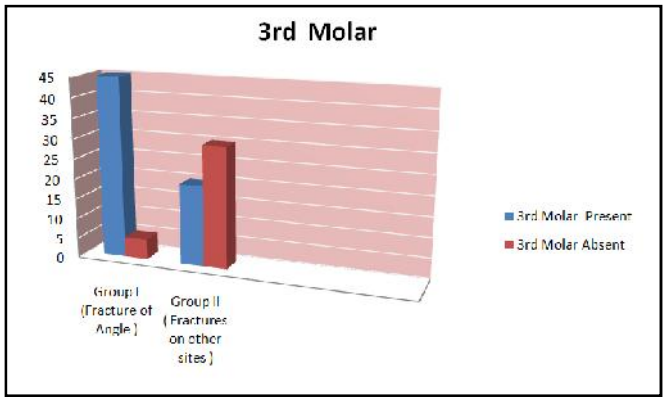
FRACTURE	Gender		Total
	Male	Female	
Angle	47 (94%)	3 (6%)	50 (100%)
Other	43 (86%)	7 (14%)	50 (100%)
Total	90 (90%)	10 (10%)	100

A statistically significant relation is present between overall incidence of mandibular angle fractures and the presence of mandibular third molar (Table.2, Graph.1). In group I, third molars were present in 90% (45/50) of all fractures; when present, in the right quadrant they were found to be impacted 32% of the time, erupted in 42% and various stages of

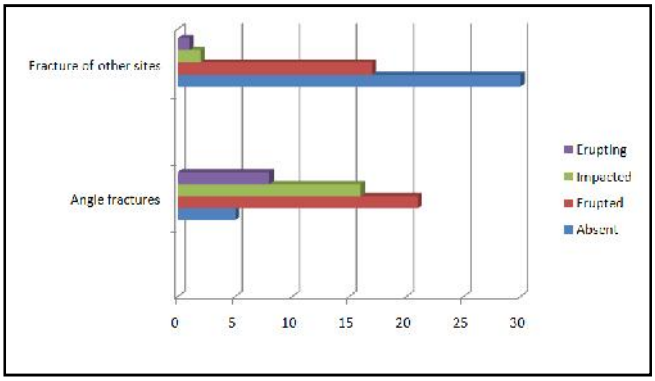
eruption in 16%; and in the left quadrant 26% were impacted, 50% were erupted and 14% in various erupting stage (Table.3, Graph 2). In group II 40% patients had mandibular third molars whereas the remaining 60 % were without 3rd molars.

Table 2. Relationship between presence/absence of third molar and fractures

Fracture	3rd Molar Present	3rd Molar Absent	Total
Group I (Fracture of Angle)	45 (90%)	5 (10%)	50 (100%)
Group II (Fractures on other sites)	20 (40%)	30 (60%)	50 (100%)
Total	65	35	100



Graph 1. Relationship between presence/absence of third molar and fractures

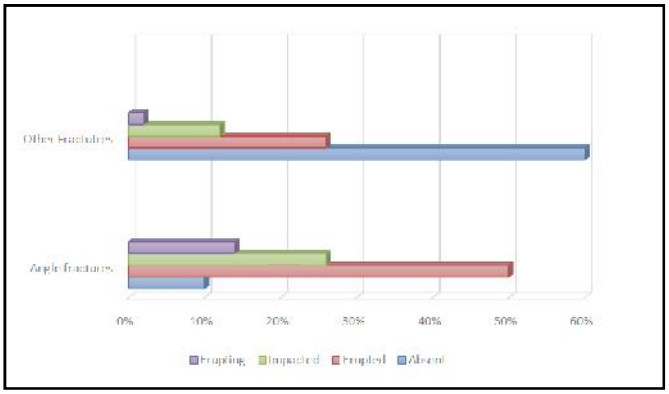


Graph 2. Relationship between the eruption status of M3 on right side and fracture

Table 3. Relationship between the eruption status of M3 on right side and fracture

FRACTURE	3rd Molar Rt. Side				Total
	Absent	Erupted	Impacted	Erupting	
Angle fractures	5 10%	21 42%	16 32%	8 16%	50
Other fractures	30 60%	17 34%	2 4%	1 2%	50
Total	35	38	18	9	100

When third molars were present in the right quadrant they were impacted in 4%, erupted in 34% and 2% in varying stages of eruption; in the left quadrant 12% were impacted, 26% were erupted and 2% were in various stages of eruption. These results signifies that the presence of third molar increases the chance of mandibular angle fractures, more so significantly (p=0.001) when it is impacted (Table 4, Graph 3).



Graph 3. Relationship between the eruption status of M3 on left side and fractures

Table 4. Relationship between the eruption status of M3 on left side and fractures

FRACTURE	3rd Molar Left Side				Total
	Absent	Erupted	Impacted	Erupting	
Angle fractures	5 10%	25 50%	13 26%	7 14%	50
Other fractures	30 60%	13 26%	6 12%	1 2%	50
Total	35	38	19	8	100

DISCUSSION

Fractures of the mandible according to Killey and Rowe, comprise between 40–65% of all facial fractures. Mandibular fracture patterns largely depend on multiple clinical factors such as the size, direction, nature and surface area of the impacting force. Other factors that are felt to be responsible include the presence of soft tissue bulk and biomechanical characteristics of the mandible, such as bone density, mass, and normal or pathologic anatomic structures creating weak areas within the bone. When an impact force is delivered to the lateral surface of the mandible, the bone bends inwards, producing compressive forces on the impacted lateral surface, and tensile forces on the lingual surface. Fractures result when the tensile strain overcomes the resistance of the bone, beginning on the medial side of the mandible and progressing through the bone toward the impact point. The pattern of mandibular fractures cannot beexplained solely on the basis of mandibular anatomy[2]. The presence of impacted third molars in the region of the mandibular angle can significantly diminish the tensile strength of the bone and encourage the propagation of the fracture along the least resistant path. Several factors have been proposed to influence the location of mandible fractures, including site, force and direction of impact, systemic disease, bony pathology and presence of impacted teeth[1, 7]. Halazonetis[1]determined the weak region of the mandible. According to his study the 'weakest' region of the mandible that fractures in one site only is the angle region and that fractures in more than one site is the condyle region and of the edentulous mandible the molar region. HUELKE et al[5]reported a significant relationship between fracture location and the presence of a tooth-bearing area. Since mandibular fractures frequently occur at or near the angle, some investigators felt that this may be attributed to the presence of an unerupted mandibular third molar. In a study by Reitzik et al[3] et al., experimental fractures were produced in monkeys and showed that mandibles containing unerupted third molars, fractured with 60% of the force required to fracture mandibles containing erupted third molars.

Bezerra et al[22] recently found, through a 3D finite element model analysis, that the presence of a mandibular third molar resulted in the greatest stress in the mandibular angle, whereas the greatest stress was concentrated at the neck of the mandibular condylar process in cases of its absence. In the study conducted by T. Meisamiet al[6] the incidence of angle fractures was found to be significantly higher in the male population and was most commonly seen in the third decade of life. Assault remained the most significant etiological factor. The third molars were largely found to be present in patients under 30 years of age and were not found in patient groups including those older than 30 years old. Hence, younger patients had significantly more third molars present and associated mandibular angle fractures than those in the older age group He also reported that Patients with third molars had thrice the increased risk of angle fractures when compared to patients without. In the study of Edward Ellis et al males accounted for 76% of all mandibular fractures; females accounted for 24%. The majority of patients were males between the ages of 10 and 40, with the peak incidence occurring in the 20- to 30-year age group. The peak incidence for women, however, occurred in the 30- to 40-year age group. In this study there were 90% males and 10% were females. On contrary to study of T.Meisami et al, in this study gender did not show a significant relationship with angle fracture. Many studies have reported that patients with unerupted mandibular third molars are more likely to have an angle fracture than those patients without unerupted mandibular third molars. The possible explanation for this relationship is that mandibular third molars weaken the mandible by decreasing the cross-section area of bone.

Fuselieret al[8]suggested that the angulation and impaction of the mandibular third Smolar were correlated with the incidence of a fracture. Patients with M3s present had a 2.1 times greater chance of an angle fracture than did patients without M3. There was a statistically significant variation in the risk for an angle fracture depending on M3 position. When M3 is impacted it occupies more osseous space and therefore weakens the mandible to outside stresses. This compares the mandibular angle, when an impacted M3 is present, with a region of pathologic weakness similar to various other conditions. Other authors have propagated this theory of a “pathologic” state of the mandible when M3s are present. Safdar and Meechan[13] reported that the more deeply the mandibular third molar was impacted, the more likely a mandibular angle fracture was to occur. Krimmelet al.[30]reported that mandibular angle region with an impacted third molar is an area of lowered resistance to external forces. Zhu et al.[14] recently reported that the absence of an impacted mandibular third molar was 3.2 times more likely to cause a mandibular condyle fracture than its presence. Duan and Zhang[10]observed that patients without a mandibular third molar were relatively more likely to suffer a mandibular condyle fracture, that a mandibular angle fracture was most frequently found in class II and level B and that a mandibular condyle fracture was most frequently found in class 0 and level 0. They also reported that the mandibular third molar had no impact on simple fractures caused by mild external forces, but affected multiple fractures caused by moderate external force in two regions: the mandibular angle and condyle. In the study conducted by Thangavelu et al.[18] observed that the presence of a mandibular third molar played an important role in causing mandibular angle or condyle fractures among patients exposed to moderate external force, which caused multiple fractures in the two regions. Furthermore, presence of a mandibular third molar was three times more likely to cause a mandibular angle fracture and was less likely to cause a mandibular condyle fracture than its absence. They reported that, based on mandibular third molar impaction, a mandibular angle fracture was more likely to occur in class II, level B, and with mesial angulation, and that mandibular condyle fracture was most likely to occur when the mandibular third molar was absent, followed by cases of class III, level C, and distal angulation. These results are consistent with the biomechanical model suggested by Koberet al.[33], in which if an impacted mandibular third molar weakens the mandibular angle, the external force is divided by the mandibular angle, thus reducing the likelihood of mandibular condyle fractures.
Deuk-Hyun Mahet al[31]reported that the ratio of mandibular angle fractures were highly significant when a mandibular third molar was present. The ratio of mandibular condyle fractures was lower when the mandibular third molar was present than when it was absent. According to him the ratio of mandibular angle fractures was higher in class II/level B, whereas no significant difference was found for mandibular condyle fractures. Mandibular angle fractures occurred most frequently with horizontal angulation, due to the root development of the mandibular third molar, while mandibular condyle fractures occurred most frequently with a tooth germ as the mandibular third molar. Naghipur et al 21 in a recent study contradicted this relationship between the position of impacted third molar and the angle fracture. He observed that no relation appeared to exist between M3 position and fracture pattern.

In this study, mandibular fractures were seen more frequently among young men. Mandibular third molars were seen more frequently in teenage patients and in patients in their twenties than those in their thirties or forties. This probably explains why mandibular angle fractures were more frequent among teenagers or people in their twenties, and why those in their thirties or forties are more vulnerable to other fracture. When relating the presence of mandibular third molar and fracture pattern, in the current study it is observed that the percentage of angle fractures was higher when the mandibular third molar was present (90%) than when it was absent(10%) which is a statistically significant finding($P<0.001$). Mandibular angle fractures are more likely to occur when third molar is impacted or in erupting stages than when it is fully erupted with a p value of 0.00. Positions of impacted mandibular third molars were assessed using PELL and GREGORY classification system and Schiller’s criteria. Present study shows a strong relationship between the presence of impacted third molar and occurrence of angle fracture, but the sample size of the patients with impacted mandibular third molars was too small to analyse statistically. Results did not confirm the hypothesized relationship between the depth of third molar impaction and increased risk of angle fractures .Therefore additional research in this area is recommended to confirm the findings and to refine the risk estimates of the various M3 positions. There are various opinion regarding the prophylactic removal of mandibular third molars in ordrer to reduce the risk of angle fracture. Schirmeret al[23]. have advocated removing impacted mandibular third molars to prevent mandibular fractures in athletes involved in contact sports. Tavepaugh and Dodson’s study[7] further supported their recommendation. Hence, if the patient is at risk of further trauma to the region of mandibular angle as a result of occupation or lifestyle, it may be appropriate to remove the tooth to strengthen the mandible

in this area.Some studies contradicted this opinion. Arunesh Tiwari et al [26] emphasised that prophylactic removal of unerupted mandibular third molar is not beneficial as it leads to an increase in the incidence of condylar fractures, which is difficult to treat and associated with more morbidity. When there is mandibular angle fracture it is easy to take a therapeutic approach as the fragments of which can be effectively reduced. In contrast mandibular condyle fracture is substantially more difficult to treat because its poor accessibility makes it hard to remove the fracture fragments and difficult to correctly apply a small metal plate and screws. These difficulties can lead to many complications, including malocclusion, mandibular hypomobility, facial asymmetry, dysfunction or degeneration, and facial nerve damage. A mandibular condyle fracture is more severe, is more difficult to treat, and leads to complications that last longer than a mandibular angle fracture. Thus it seems unreasonable to suggest preventive removal of the mandibular third molar with the objective of reducing the likelihood of mandibular angle fractures.

Conclusion

The presence of the mandibular third molar can be a determinant of mandibular fractures. This case control study aimed at evaluating the presence of mandibular third molar as a risk factor for angle fracture. Based on the findings of our study, the following conclusions were derived.

1. There is an increased risk of angle fractures in the presence of a lower third Molar.
2. Presence of unerupted M3 shows a significant relationship with mandibular angle fracture than the erupted M3.
3. Gender and etiological variables did not have a significant relationship with the mandibular fracture pattern.
4. On considering age variable, patients in their twenties and thirties are more prone to have mandibular angle fracture which can be attributed to the presence of M3

On the basis of results of the present study, it can be concluded that the risk of angle fractures was higher when the mandibular third molar was present. Mandibular angle fractures are more likely to occur when third molar is impacted or in erupting stages than when it is fully erupted. In our study the relationship between fracture and position of impacted third molar was not analyzed. Further studies with large sample size are necessary to corroborate the findings of the present study.

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Ethical Considerations: Due to the sensitivity of the information gathered subject confidentiality was maintained at all times. The subject‘s medical status were not divulged to anyone. Only the researcher, supervisor had access to the data. The names of subjects were not mentioned in any of the data collecting sheets. The consent form and study protocol were previously approved by the Institutional ethics and research committee, Government Dental College, Kozhikode (IEC no: 52/2014/DCC).

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