Complication rates in angle fractures with or without retaining third molars: A comparative study

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Abstract
Aim: The aim of this study is to assess whether the third molar in the line of mandibular angle fracture predisposes to post-operative infection, which further may lead to implant retrieval.
Materials and Methods: Surgically rehabilitated cases of mandibular angle fracture at our center Sanjay Gandhi institute of trauma and orthopedics from 2016 to 2019 were considered in the study. During this period 49 cases were followed up for over a period of 6 months at 3 moths and 6months interval. All the cases were operated by the same surgeon using universal aseptic precautions using semi- rigid fixation.
Results: Out of 49 cases, 20 cases the third molar was removed and in 29 cases the third molar was retained. The mean age group of the population of the study was 33.67 (18 to 60 years), out of which majority of the cases 93.9%(46) were male patients and 6.3%(3) were female patients. The main etiology of the cases were attributed to RTA. 96.3%. At the end of the 6 months follow up it was noted that 4 plates in case of retained group and 2 plates in removed group. In the 3 month follow up in 4 cases of the retained third molar was extracted due to signs of infection. When the tooth in question was removed, infection did not occur. At the 3rd to 6 month follow another 4 retained third molars were extracted along with implant retrieval.
Statistically the relationship between the two groups were analyzed using Chi-square test bivariate statistics. A $P \leq 0.05$ was taken as significant.
Conclusion: In our study we could not provide any concrete evidence to form a protocol for the management for the third molar in the line of mandibular angle. Retaining the third molar in the line of fracture has an increased chance of post-operative infection. We would like to conclude that partially impacted tooth are best to be removed during the procedure for better outcomes provided the fractured segments stability is maintained. Until an algorithm is set for the management of the third molar in the line of fracture, the dilemma of retaining or removing still stays and varies from case to case and on the surgeon's experience.

Keywords: Mandibular angle, Third molar, Tooth in line of fracture.

Introduction
The most commonly fractured facial bone is the mandible due to its prominent position. Around 27-30% of all mandibular fractures are in the angle region due to the change in the direction of forces from the dentate to the non-dentate region.[1,2] The treatment of angle fracture is often complicated and debated upon due to the presence of the mandibular third molar in the line of fracture.[1] The presence of the third molar increases the risk of angle fractures when compared to its absence.[3] It is also observed that the rate of post op infection is the highest of angle fractures due to the poor accessibility for oral hygiene aids, operative method and the most important determining factor- the tooth in line of fracture.[4] The debate of preserving the tooth or extracting it has been a prevalent question among the maxillofacial fraternity ever since the evolution of open reduction and fixation. Never the less there has been no set algorithm for the same. Thus this study aimed to determine, whether the tooth in line of fracture predisposed to infection which in turn may lead to retrieval of implants.

Materials and Methods
A retrospective study was conducted of the inpatient medical records of patients with mandibular angle fractures at the department of facio-maxillary surgery, Sanjay Gandhi institute of trauma and orthopedics. The inclusion criteria were: patients with angle fracture that required open reduction and internal fixation, age between 18-60 years irrespective of gender, the exclusion criteria was- patients with pre-existing medical conditions, infected fracture site, patients who were treated by closed reduction and patients having less than 6 months follow up were excluded. In all patient's fractures were reduced with upper and lower arch bar fixation as a means for intermaxillary fixation intraoperatively. All patients were operated under general anesthesia following routine hematological, biochemical, general physical examination and routine radiological examination.

Intraoral vestibular incision was used to approach the fracture, anatomic reduction was obtained and plating was done. The third molar was removed when the teeth were fractured, pre-existing pericoronal/periodontal infection, dental caries, tooth mobility, exposure or involvement of the apical half or more of the root, and third molar does not compromise the reduction of bone fragments. For the purpose of this study, postoperative infection was defined as that has a purulent discharge requiring surgical intervention including removal of plates.

For all the cases semi-rigid fixation was done with plates and screws after fracture reduction, standard analgesics and antibiotic coverage were given. Such data collected were entered and analyzed. Descriptive statistics for the predictor and outcome measures are presented.

In the present study, 49 cases were enrolled for the study, divided into two groups – group 1 in which third molar was retained and group 2 in which third molar was extracted. Initially 29 cases had their third molar extracted and another 6 extractions in the 3 months followed. Further 4 molars were needed to be extracted in the 3–6th month follow-up. The cause for removal included development of pain, redness, discharge indicating periodontal problems including mobility and periapical lesions. Keeping the progress of healing of the bone in mind these teeth were extracted. At the 3rd month follow up 4 teeth which were initially retained were extracted when signs of infection were first seen. At the 6th month follow up the implants were removed along with extraction of the teeth, in the retained group i.e. 4 in number and 2 cases of implant removal in the removed group.

Results

There were a total of 49 patients with mandibular angle fracture who underwent open reduction and internal fixation. 40.8% (n=20) the third molar was removed, while in 59.2% (n=29) retained (Table 1). The mean age group of the population of the study was 33.67 (18 to 60 years), out of which majority of the cases 93.9%(46) were male patients and 6.3%(3) were female patients (Table 2). The etiology of the cases were attributed to RTA and assault, the former being in majority of cases, i.e. 96.3% and 6.9% respectively. The side of the angle fracture in this study were almost similar, incidence of left side fracture being 51% and the right side fracture being 49%. In 49% (24) cases the third molar was completely erupted and 51% (25) were impacted third molars. In the impacted molars 48% were mesioangular, 40% were vertical and 12% were distoangular (Table 3). At three months follow up, based on the signs of infection it was decided to extract the third molars. The signs and symptoms considered were – pain, redness or discharge at the third molar site. At the end of the third month, 4 cases showed signs of infection in the retained group due to which extraction of the third molar was carried out under local anesthesia following aseptic precautions. There were no re fractures during extraction. Out of the 49 cases included in this study 6 cases underwent implant removal. 4 in case in retained group and 2 in the removal group. In the retained group, extraction of the third molar was carried out along with removal of the implant. A p value of 0.16 was noted and a Chi square value of 1.86 (Table 4).

Table 1: Distribution of the subjects based on retainment or removal of third molar

	Frequency	Percent
3rd molar Removed Group	20	40.8
3rd molar Retained Group	29	59.2
Total	49	100.0

Table 2: Mean age distribution of the subjects

	N	Minimum	Maximum	Mean	Std. Deviation
Age	49	18	60	33.67	12.378

Table 3: Cross-tabulation of 3rd molar impaction and type of impaction

Type of impaction		3rd molar impaction		Total
		Complete	Partial	
Not applicable	Count	24	0	24
	Percent	100.0%	0.0%	49.0%
disto-angular	Count	0	3	3
	Percent	0.0%	12.0%	6.1%
mesio-angular	Count	0	12	12
	Percent	0.0%	48.0%	24.5%
vertical	Count	0	10	10
	Percent	0.0%	40.0%	20.4%
Total	Count	24	25	49
	Percent	100.0%	100.0%	100.0%

Table 4: Cross-tabulation of 3rd molar retainment and implant retrieval

Implant retrieval		3rd molar retainment		Total
		Retained	Removed	
Retained	Count	16	27	37
	Percent	80%	93.1%	75.5%
Retrieval	Count	4	2	12
	Percent	20%	6.9%	24.5%
Total	Count	20	29	49
	Percent	100.0%	100.0%	100.0%
Chi-square value- 1.89				
P value- 0.16				

Discussion

The aim of this retrospective study was to identify the fate of the third molar along the line of fracture in mandibular angle fracture over a period of 6 months. This has always been a question of debate and the risk pertaining to retaining or removing the tooth has been varyingly assessed in literature ever since evolution of open reduction and fixation for maxillo facial fractures were introduced.

In the present study, angle fracture was observed in the age group ranging from 18 to 60 years and the mean age was 33.67 years. Based on age the patients were classified into three categories i.e. younger age group 18 to 30 years, middle aged group 31 to 50 years, and older age group - above 50 years. Out of the 49 patients included in the study, 30 belonged to the young group, 12 to the middle age group and 6 to the old age group, indicating that majority of the angle fractures occurred in younger age group, and road traffic accidents being the most common cause of it. This result was in consistent with the results of the study conducted by Sakr et al, who reported that incidents of angle fracture between 20-29 years is higher. The reason is due to the fact that a high incidence of un-erupted third molars are seen in this age group.[5] Our study consisted of 93.9% of male patients and 6.1% of female patients. This observation was in agreement with studies conducted by Dongas et.al and Mahesh Kumar et al who reported male predominance in angle fractures due to the fact that they are more exposed to the risk factors for facial trauma as they are prone to get involved in violent conduct, indulging in reckless driving, exhibiting physical aggression and engaging in contact sports.[6,3] The majority of the cases had an etiology of road traffic accidents i.e. 93.9

and 6.1% of cases had an etiology of assault. This result was consistent with the study conducted by Ugboko et who had observed that road traffic accidents were the main cause of mandibular angle fractures. This is attributed to multiple reasons, but the main reason being lack of road safety awareness, violation of traffic rules like over-speeding and not using helmet, use of alcohol or other intoxicating agents.[7]

We found 25 (51%) cases of mandibular angle fracture on the left side as compared to 24 (49%) on the right side. This was in agreement with the study findings of Inaoka et al., where they proved left side had more angle fractures than the right side. However, the side did not present a significant relationship with angle fracture. The site of impact is usually restricted to the side of fall. If the impact is of a high velocity, then a direct fracture at the point of application will occur. If the impact is of a low velocity, the bow will transfer to the contralateral side, causing an indirect fracture.[8]

In case of assaults, considering the predominance of the right-handed people, the victim will be facing the opposite direction and hence the site of fracture is to the side of impact. In our study we noted that all the assault cases had an angle fracture on the left side.

In our study 49% of the cases had their third molar completely erupted whereas as 51% of the cases exhibited impaction of the third molar due to the fact that majority of the cases belonged to the young age group. Among the impacted cases, it was noted that mesioangular impaction was the most common type of impaction this was in agreement to the study findings of Fuselier et al.[9] it was attributed that mesioangular impacted teeth are more prone to angle fracture as the root is directed towards the angle of mandible, which may act as a wedge splitting the mandibular angle, because of which the injury forces are redirected towards the mandibular angle, and decreased amount of bone in that area increases the risk of angle fracture. Mandibular angle fractures observed along with other impaction positions of third molars in decreasing order were: Vertical, horizontal, and distoangular. The type of impacted teeth did not have a role in deciding whether the tooth needed to be removed or retained intra-operatively. In the post-operative follow – up period it was noted that signs of infection which led to the removal of the impacted teeth were noted more in partially impacted cases. The study conducted by Balaji et al was in agreement to our stud, this was simply because of the position of the tooth which makes it an area for harboring debris and pathogen which in-turn led to periodontal infection.[4]

In a recent systematic review by Bobrowski et al, of the 1542 cases, tooth was removed in 788 (51.1%). During the follow-up period infection occurred in 84 cases (10.66%). On other hand, 84 cases out of 754 in the retained group showed signs of infection. This had no statistical significance. Thus the study was concluded by saying that retaining or removing the third molar did not have a significant effect on infection.[10]

The notion of performing extractions as a prophylactic measure was implemented in pre-antibiotic era in order to avoid infections, this was followed as a norm or protocol to remove the entire tooth in lines of fracture. This was basically done under the impression that such tooth would be a danger area through which microbes would seep in and cause infections. With the introduction of antibiotics and antimicrobials and also better aseptic surgical protocols the efforts were made in order to save the healthy tooth while the medications took care of the untoward complications of the microbes. However, the effect of a tooth in the line of fractures cannot not be under estimated. In an article by Ellis et al, Muller had recommended that multi-rooted tooth in the line of fracture be always removed.[11]

In another similar study with the same sample size conducted by Lim et al, 49 patients had third molars in the line of fracture. The third molar were retained in 39 cases and the third molars were extracted in the rest of the cases. It was noted that several patients in the retained group exhibited post op infections, nerve paresthesia, temporomandibular disorders and also change of occlusion. Whereas in case of the group in which the third molars were extracted, they noticed that the patients presented with only nerve injury. However this study also did not yield a statistically significant value.[12] In our study we did not encounter any TMD or nerve injury cases, although post-operative infection was noted.

In a study conducted by Kahnberg and Ridell it was found that the teeth which were retained along the fracture line resulted in satisfactory healing, which was around 59%.[13] This was later supported by works of Macan et al.[14] Other teeth have relatively better access and survival rate with adjuvant treatments like root canal therapy while the third molar would lack the same. Also, this study proves that fully impacted third molar teeth when removed did not cause any further infection, while the partially impacted teeth which were left behind, proceeded to infection and subsequent loss of teeth. They also mentioned the two possibilities of the third molar, on one hand, the partially erupted teeth (or partially impacted) when left behind possess as an inaccessible area (for self-cleansing) which further can act as a point of entry for the micro-organisms. On the other hand, if extracted, the defect along the superior margin of the mandible during course of healing could again serve as an area of weakness as well as a portal of entry for microbes. Thus they stated that even the partially impacted third molar, along the line of fracture which does not have a role in stabilizing the fracture, may be removed during fracture reduction itself.

In our study the difference in survival of third molar was not statistically significant between right and left side. The partially impacted teeth, due to its position would harbor more debris and pathogens contributing to poor periodontal health. Although this finding did not yield a statistically significant it was what we inferred from our study.

Conclusion

In our study we could not provide any concrete evidence to form a protocol for the management for the third molar in the line of mandibular angle. Although retaining the third molar has an increased chance of post-operative infections it is not statistically significant. Also as discussed many other reasons also lead to the post-operative infections. As said that we would like to also to conclude that partially impacted tooth

are best to be removed during the procedure for better outcomes provided the fractured segments stability is maintained. Until an algorithm is set for the management of the third molar in the line of fracture, the dilemma of retaining or removing still stays and varies from case to case and on the surgeon's experience.

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Conflict of Interest
None.

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