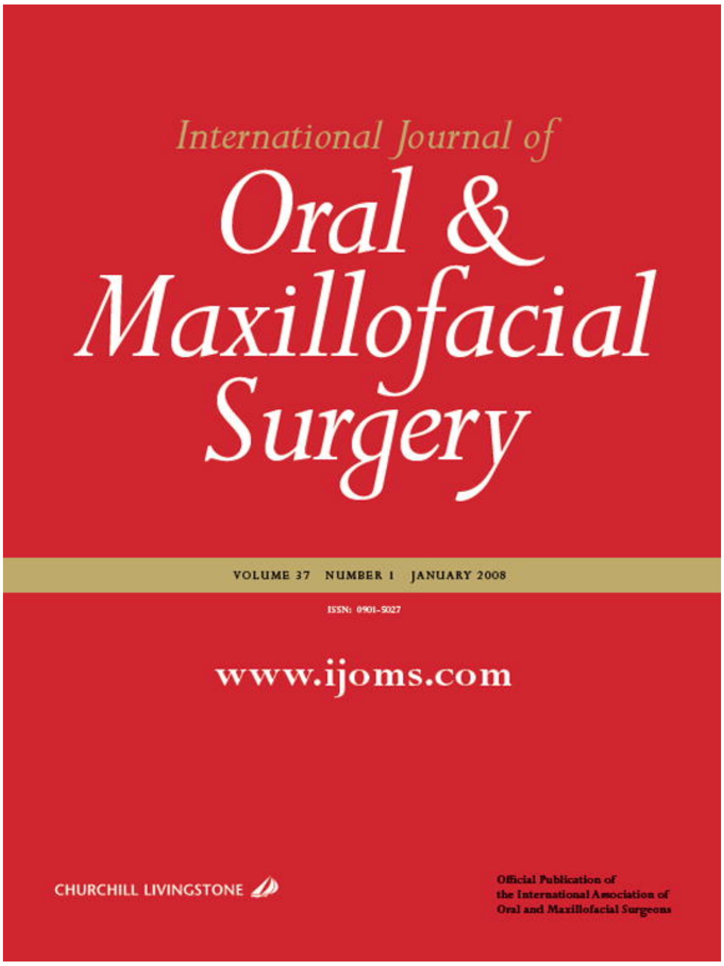
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Clinical Paper
Trauma

Does the presence of mandibular third molars increase the risk of angle fracture and simultaneously decrease the risk of condylar fracture?

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Abstract. Previous studies have shown that impacted mandibular third molars (M3s) increase the risk of mandibular angle fractures and decrease the risk of mandibular condylar fractures. This study attempted to verify these relationships and identify the influence of mechanism and cause of injury. The incidence of fractures was compared in 700 patients with and without impacted M3s. The results showed that patients with impacted M3s had a lower risk of condylar fracture and a higher risk of angle fracture than those without impacted M3s when injured by moderate trauma force. Such relationships could not have been identified when patients were injured by high trauma force. Patients with impacted M3s had a higher risk of angle fracture than those without impacted M3s no matter how they were injured (assault, fall, motor vehicle accident, other). When patients were injured by assault or in a motor vehicle accident, those with impacted M3s were less likely to have a condylar fracture. M3s were a dominant factor for developing a mandibular angle fracture and preventing condylar fracture. The risk of angle fracture was much more affected by impacted M3s than that of condylar fracture, when injury mechanism and cause were taken into consideration.

Key words: lower third molar; impacted mandible third molar; mandibular angle fracture; condylar fracture.

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Retrospective studies have reported that patients with impacted mandibular third molars (M3s) were more at risk of mandibular angle fractures than those without impacted M3s. Risk of fracture was also dependent on M3 position[6,8,9]. An inverse relationship was seen for condylar fractures: patients with impacted M3s were less likely to have a condylar fracture than those without impacted M3s[4,10]. If impaction of M3s plays such an important role in these fractures, do other variables, such as

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Table 1. Horizontal and vertical position of M3s

Horizontal	Amount of space available between ramus and second molar
Class I	Adequate space for eruption
Class II	Inadequate space for eruption
Class III	Third molar located partially or completely in ramus
Vertical	**Relationship of third molar crown to second molar crown**
Class A	Level at occlusal plane
Class B	Between the cemento-enamel junction of the second molar and occlusal plane
Class C	Below the cemento-enamel junction of the second molar

Class 0: no M3s.

position of M3s, injury mechanism and injury cause, also influence the pattern of fracture? To answer these questions the medical records were reviewed of 700 patients treated for mandible fractures.

Patients and methods

From January 1991 to April 2005, 902 patients were treated for mandible fractures at Peking University School and Hospital of Stomatology, Department of Oral and Maxillofacial Surgery. The case records were collected and retrospectively reviewed. Data collected included age, sex, injury cause (motor vehicle accident, assault, fall, other), position of M3s and fractures sites. Diagnosis of fracture sites was made by clinical examination and panoramic radiograph. Excluded from the study were 202 patients aged 16 years or younger.

The magnitude of trauma force was defined based on the number of mandibular fracture sites: low trauma force resulting in one mandibular fracture site, moderate trauma force resulting in two mandibular fracture sites, and high trauma force resulting in three or more mandibular fracture sites.

To analyse the position of M3s the Pell and Gregory Classification was used to identify horizontal position (Class I, Class II and Class III) and vertical position (Class A, Class B and Class C)[5]. The absence of M3s was indicated by Class 0 (Table 1). Based on this classification, Class IA was not regarded as impacted but fully erupted. All remaining classifications of M3s were viewed as impactions. Patients designated as Class 0 and/or Class IA in both mandibular halves were placed into the M3 absent group. Mandibular angle fracture was determined by the definition given by Kelly & Harrigan[2]: fracture located posterior to the second molar, extending from any point on the curve formed by the junction of the body and ramus in the retromolar area to any point on the curve formed by the inferior border of the body and posterior border of ramus of the mandible. Condylar fracture was defined as a fracture with the fracture line superior to the sigmoid notch.

The database was constructed and analysis performed using SPSS version 10.0 (SPSS, Inc., Chicago, IL, USA). Data were analysed by calculating the means and standard deviation, and the cohort comparisons were made by the χ^2 test, the Student's *t*-test, and analysis of variance. Data were considered significant with $P < 0.05$.

Results

The cohort consisted of 700 patients with 1280 mandibular fractures. Motor vehicle accident was the most common reason for mandibular fracture (305, 44%), followed by assault (169, 24%), fall (129, 18%) and other (97, 14%). The most common fracture pattern was bi-fracture, a group consisting of 301 patients (43%). In decreasing order the other groups were mono-fracture with 268 patients (38%) and multi-fracture with 131 patients (19%). Fractures of the mandible symphysis were observed most frequently (33%), followed by condyle (32%), body (16%), angle (16%) and ramus (3%). Mandibular angle fractures were seen in 197 patients, 5 patients had bilateral angle fractures. Condylar fractures were observed in 300 patients, 112 with bilateral condylar fractures. Twenty-two patients had a condylar and an angle fracture simultaneously, including eight patients with both fractures on the same mandibular side.

The cohort of 700 patients had 1400 mandibular halves, of which 302 (22%) had no M3s. Among the 1098 (78%) mandibular halves containing an M3, the most common horizontal position was Class I (525, 38%), followed by Class II (322, 23%) and Class III (251, 18%). The most frequent M3 vertical position was Class A (656, 47%), followed by Class B (348, 25%) and Class C (94, 7%). A detailed analysis of the variables studied is shown in Table 2. Patients with impacted M3s were statistically younger and more likely to be male than patients without impacted M3s. Patients sustaining condylar fractures were statistically older and more likely to be female than those without condylar fractures.

Collectively the data revealed that patients without impacted M3s had a higher risk of sustaining condylar fractures than patients with impacted M3s ($P < 0.05$). Regarding angle fractures the opposite was noted: patients with impacted M3s sustained a higher risk for angle fractures than those without impacted M3s ($P < 0.05$). Table 3 summarizes the relationship between impacted M3s and the risk of condylar and angle fractures.

Concerning the horizontal position of impacted M3s, the highest incidence of angle fractures was observed in Class II (31%), followed by Class III (16%), Class I (9%), Class 0 (5%). The highest incidence of condylar fractures was seen in Class 0 (36%), followed by Class I (31%), Class III (26%), Class II (23%). Similarly, opposite correlations were observed between the two site fractures and M3 vertical position. The highest incidence of angle fractures was observed in Class B (26%), followed by Class A (13%), Class C (10%), Class 0 (5%). The highest incidence of condylar fractures was

Table 2. Variables grouped by impacted M3s, mandibular angle and condylar fracture

	Impacted M3s		Angle fracture		Condylar fracture	
Variable	Absent ($n = 330$)	Present ($n = 370$)	Absent ($n = 504$)	Present ($n = 196$)	Absent ($n = 400$)	Present ($n = 300$)
Age (years)	35.1 ± 10.9	27.9 ± 9.5**	31.9 ± 10.8	29.7 ± 10.6*	30.8 ± 10.1	32.0 ± 11.6**
Sex						
Male	254	309	399	164	332	231
Female	76	61**	105	32*	68	69**

* $P > 0.05$.
** $P < 0.05$.

Table 3. Relationship between impacted M3s and the risk of condylar and angle fracture

	Condylar fracture			Angle fracture		
Impacted M3s	Absent	Present	*P*	Absent	Present	*P*
Absent ($n = 330$)	163 (49%)	167 (51%)	0.000	285 (86%)	45 (14%)	0.000
Present ($n = 370$)	237 (64%)	133 (36%)		218 (59%)	152 (41%)	

Table 4. Relationship between M3 position and risk of condylar and angle fracture

	Condylar fracture			Angle fracture		
M3s	Absent	Present	*P*	Absent	Present (%)	*P*
Horizontal position						
Class 0 ($n = 302$)*	194 (64%)	108 (36%)	0.003	287 (95%)	15 (5%)	0.000
Class I ($n = 525$)	361 (71%)	164 (31%)		478 (91%)	47 (9%)	
Class II ($n = 322$)	247 (77%)	75 (23%)		223 (69%)	99 (31%)	
Class III ($n = 251$)	186 (74%)	65 (26%)		211 (84%)	40 (16%)	
Vertical position						
Class 0 ($n = 302$)*	194 (64%)	108 (36%)	0.003	287 (95%)	15 (5%)	0.000
Class A ($n = 656$)	462 (70%)	194 (30%)		569 (87%)	87 (13%)	
Class B ($n = 348$)	269 (77%)	79 (23%)		258 (74%)	90 (26%)	
Class C ($n = 94$)	63 (67%)	31 (33%)		85 (90%)	9 (10%)	

* Class 0: no M3s.

observed in Class 0 (36%), followed by Class C (33%), Class A (30%), Class B (23%) (Table 4).

With respect to injury mechanism, patients with impacted M3s had a lower risk of condylar fracture (34%) and a higher risk of angle fracture (59%). Patients without impacted M3s had a higher risk of condylar fractures (55%) and a lower risk of angle fractures (19%) when injured by moderate trauma force ($P < 0.005$). Injured by low trauma force, patients with impacted M3s had a higher risk of angle fracture than those without impacted M3s, 27% and 12%, respectively ($P < 0.05$), whereas the difference was not statistically significant for condylar fracture (Table 5). Patients with or without impacted M3s showed no statistically significant difference when injured by high trauma force.

Considering injury causes, patients with impacted M3s had a higher risk of angle fracture than those without impacted M3s no matter how they were injured ($P < 0.05$). When patients were injured by assault or motor vehicle accident, those with impacted M3s were less likely to have a condylar fracture than those without impacted M3s ($P < 0.05$) (Table 6).

Discussion

Clinical investigations have implied that impacted M3s are a risk factor for mandibular angle fractures and the risk is also dependent on M3 position[6,8,9]. Similar results were observed in this study. Patients with impacted M3s sustained a higher risk for angle fractures than those without impacted M3s. The resistance to angle fractures is decreased by the presence of impacted M3s[6,8]. The highest risk was observed in patients with M3 position of Class II and Class B, whereas patients without M3s had the lowest risk of sustaining an angle fracture. Similar results were obtained by Fuselier et al. with a cohort of 1210 patients[1]. Mandibular angle fractures have an area of tension at the superior border and an area of compression at the inferior border. These areas of tension and compression are demonstrated by muscle insertion, muscle force and bite force positioned on the proximal and distal segments of the fracture[7]. Impacted M3s disrupting the cortical bridge of the superior border cause an inherent weakness in the mandibular angle. Less force and muscle tension are needed to cause an angle fracture. This could explain why the highest risk of angle fractures was observed for Class II and Class B positions of M3s, in which the superior border was interrupted, rather than Class III and Class C with the superior border intact.

Previous authors also discovered that the presence of M3s decreased the risk of condylar fractures[4,10], as confirmed by the present study. This study revealed that the risk of condylar fractures was also dependent on M3 position. The highest incidence of condylar fractures was in Class 0, followed by Class I, Class III and Class II. By vertical positioning, the

Table 5. Relationship between impacted M3s and risk of condylar and angle fracture in terms of injury mechanism

	Condylar fracture			Angle fracture		
Impacted M3s	Absent	Present	*P*	Absent	Present	*P*
Low trauma force						
Absent ($n = 134$)	107 (80%)	27 (20%)	0.261	118 (88%)	16 (12%)	0.002
Present ($n = 134$)	114 (85%)	20 (15%)		98 (73%)	36 (27%)	
Moderate trauma force						
Absent ($n = 119$)	53 (45%)	66 (56%)	0.000	97 (82%)	22 (19%)	0.000
Present ($n = 182$)	120 (66%)	62 (34%)		75 (41%)	107 (59%)	
High trauma force						
Absent ($n = 77$)	3 (4%)	74 (96%)	0.982	70 (91%)	7 (9%)	0.192
Present ($n = 54$)	3 (6%)	51 (94%)		45 (83%)	9 (17%)	

Table 6. Relationship between impacted M3s and risk of condylar and angle fracture in terms of injury causes

	Condylar fracture			Angle fracture		
Impacted M3s	Absent	Present	*P*	Absent (%)	Present (%)	*P*
Assault						
Absent (84)	54 (64%)	30 (36%)	0.008	69 (82%)	15 (18%)	0.000
Present (85)	70 (82%)	15 (18%)		40 (47%)	45 (53%)	
Fall						
Absent (67)	23 (34%)	44 (66%)	0.482	62 (93%)	5 (8%)	0.001
Present (62)	25 (40%)	37 (60%)		44 (71%)	18 (29%)	
Vehicle						
Absent (143)	63 (44%)	80 (56%)	0.008	122 (85%)	21 (15%)	0.000
Present (162)	96 (59%)	66 (41%)		102 (63%)	60 (37%)	
Other						
Absent (36)	23 (64%)	13 (36%)	0.226	32 (89%)	4 (11%)	0.000
Present (61)	46 (75%)	15 (25%)		32 (53%)	029 (48%)	

highest risk of a condylar fracture in decreasing order was in Class 0, Class C, Class A and Class B. Kober et al. suggested that if the angle was weakened by incompletely erupted M3s, the possibility of condylar fracture would decrease as impact forces would be dissipated by the angle fracture. On the contrary, if the angle was intact with no M3s or fully erupted M3s, it would be resistant to fracture and more impact forces would transmit to the condyle and result in fracture[3].

The results of this study revealed that injury mechanism was also an important factor. For patients injured by a moderate traumatic force resulting in two fractures of the mandible, impacted M3s played an important role in angle/condylar fracture. For patients injured by a high traumatic force, an influence of impacted M3s on angle/condylar fracture was not demonstrated. The severity of injury was the primary factor resulting in multiple fractures, not the presence or absence of M3s. In patients with a single fracture, indicating a low traumatic force, impacted M3s increased the risk of angle fracture. The absence or presence of M3s had no influence on condylar fractures sustained by patients in the mono-fracture group. This could be explained by the low force of injury: a fracture would occur at the condyle, due to its intrinsic weakness, rather than the angle with M3s. Considering injury causes, the risk of angle fracture was much more affected by impacted M3s than that of condylar fracture. Patients with impacted M3s were at higher risk of angle fractures than those without impacted M3s no matter how they were injured.

In conclusion, M3s are a dominant factor for mandibular angle/condylar fractures and the risk is dependent on M3 position. The risk of angle fractures was much more affected by impacted M3s than that of condylar fractures, when injury mechanism and injury causes were taken into consideration. With respect to prophylactic M3 extraction, it appears that impacted M3s in patients with a high risk of suffering low trauma forces should be extracted, whereas patients more often subjected to moderate or high trauma forces might not benefit from prophylactic M3 extraction.

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