


Association of Impacted Mandibular Third Molar with Caries on Distal Surface of Second Molar

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Abstract

Objective: To evaluate the relationship of impacted mandibular third molars (M3M) status with caries on distal surface (CODS) of mandibular second molars (M2M). **Material and Methods:** A retrospective study on digital panoramic radiographs. Information on age, gender, eruption status of impacted mandibular third molars and mandibular second molars caries on distal surface were recorded. Winters' classification and Pell and Gregory classification were used to classify impacted mandibular third molars. The Chi-square test and Poisson regression were used. A p-value of <0.05 was considered statistically significant. **Results:** A total of 1497 radiographs were evaluated out of which 2704 sites were recorded. A total of 33.2% M3M were impacted and 1053 (38.9%) M2M had caries on distal surface. Among the total M3M teeth, 39.1% of erupted and 38.6% of impacted teeth had CODS of M2M. However, there was no significant difference in the distribution of CODS of M2M in erupted and impacted mandibular third molars teeth ($p=0.796$). As per Winters classification, mesio-angular and horizontal impaction types were significantly associated with CODS ($p<0.001$). **Conclusion:** All impacted mandibular third molars may not be associated with caries on distal surface of mandibular second molars. But, the angulation like mesioangular and horizontal, class I and II may predispose to caries on distal surface of mandibular second molars.

Keywords: Surgery, Oral; Tooth, Impacted; Molar, Third; Dental Caries.

Introduction

Impacted third molars are implicated in the etiology of many comorbidities in the oral cavity like pericoronitis, abscesses, cysts and tumors. They are considered vestigial and have no role to play in oral cavity but can adversely affect adjacent healthy tooth. Selective research has been done by many clinicians on development of distal caries (CODS) on mandibular second molar (M2M) due to impacted mandibular third molar (M3M) [1-4].

Literature search has clearly shown an association between the 3rd molar status and caries on distal surface of the second molar [4-6]. Previous studies have reported various factors like angulation (mesio-angular impaction [4], angulation of 31° or more and gender [6]; 30°-70° [7], 61-80%), position of third molar at A, and distance of 7-9mm between the distal cemento-enamel junction (CEJ) of the M2M and the mesial CEJ of 3rd molar [1] have contributed in development of CODS of M2M. All these factors facilitate plaque accumulation and food wedging on distal surface of 2nd molars.

Impacted teeth have a close contact to cemento-enamel junction of the mandibular second molar and can have a high chance of development of CODS on mandibular second molars. Studies have also reported altered microbial colonies and inflammatory mediators which could also have a possible role in the initiation of localized periodontitis and caries both on 2nd and 3rd molars [8,9].

CODS in mandibular 2nd molars have difficulty in restoration, subgingival caries and may also have alveolar bone loss. Considering these factors, impacted mandibular 3rd molars are often indicated for extraction. Hence removal of the third molar remains the most frequent surgical procedure performed by the dental surgeons. Apart from the established reasons for the removal of wisdom teeth, extraction due to proximal caries on distal surface (CODS) of mandibular 2nd molars (M2M) ranged from 4.2 to 37.5%.

Previous studies have been conducted to evaluate the association of caries on distal surface of mandibular second molars with mandibular third molars using various modalities like clinical examination [1], periapical [6], bitewings [5] and panoramic radiographs [4,7,10]. Each type of modality has its own advantages and limitations. In view of these factors, we aimed to evaluate the relationship of mandibular 3rd molar status with caries on the distal surface of mandibular 2nd molars among subjects who attended dental outpatient department. The main objective behind conducting this study was to evaluate high-risk patients and formulate a protocol for early diagnosis of this pathology along with proposal of prophylactic removal of mandibular third molar in the former condition.

Material and Methods

Study Design

A retrospective study was conducted on digital panoramic radiographs of the patients who attended outpatient department of oral medicine and oral surgery for evaluation of third molar.

Data Collection

Data for this study was obtained from the extra-oral digital radiography database of Department of Oral Medicine and Radiology of Manipal College of Dental Sciences, Manipal. Digital radiographs from January to December 2016 were retrieved and delinked by removing the patient identifiers other than age and gender.

A two-staged protocol was followed for the evaluation of the digital radiographs. In the first stage, an expert radiologist had evaluated the suitability of the radiograph for the study based on the criteria (presence of M2M, M3M and opposing teeth) and delinked the patient identifiers. This was followed by the evaluation of M3M and M2M statuses on both right and left sides. M3M were evaluated for eruption status (Impacted or erupted) and M2M were evaluated for CODS (present or absent). Impacted M3M were further classified based on Winters' [11] and Pell & Gregory classification [12].

The Pell and Gregory classification was used to classify the depth of lower third molar in relation to occlusal plane (Class A, B, C) and the distance between the ascending border of anterior surface of mandibular ramus and the distal surface of the second molar (Class I, II, and III) [12]. The occlusal surface of the mandibular second molar and the cemento-enamel junction of the mandibular second molar were considered as the reference level for the same. The variables included for the study group comprised of age, gender, eruption status of the third molars and their angulation in relation to mandibular second molar. The control group consisted of subjects who have completely erupted mandibular third molar present distal to second molar.

Radiographs of subjects with orthodontic treatment or any pathological alterations or digital panoramic radiographs were recorded using Planmeca Promax with 60KVP and 15mA (Planmeca Oy, Helsinki, Finland). A total of 1497 radiographs were evaluated, of which 1018 (68%) participants were male. The mean age was 36.69 ± 15.11 years. Among the total radiographs, 2704 sites were evaluated in which 899 (33.2%) mandibular 3rd molars were impacted and 1053 (38.9%) mandibular 2nd molars had caries on distal surface.

All the data recording about assessment of panoramic radiographs were made by single trained and calibrated examiner (experience of 8 years). Training and calibration was done in two sessions by expert radiologist (experience of 13 years) for evaluating 3rd molar status and diagnosis of dental caries on mandibular 2nd molar. Intra-examiner reliability for the assessment of dental caries was evaluated by Kappa coefficient ($K=0.95$).

Data Analysis

All the analysis was done using IBM SPSS Statistics for Windows Software, version 18 (IBM Corp., Armonk, NY, USA). A p-value of <0.05 was considered statistically significant. Comparison of categorical variables was done by Chi-square test. A Subgroup analysis in impacted M3M's was done by Poisson regression with independent variables as Winters' and Pell & Gregory classifications and dependent variable as CODS.

Ethical Aspects

Permission to conduct the study was obtained from the appropriate authorities. Prior permission from institutional ethics committee was sought (IEC 63/2017).

Results

Among the total teeth evaluated, it was observed that 39.1% (n=706) of erupted 3rd molar and 38.6% (n=347) of impacted 3rd molar were associated with caries on distal surface of mandibular 2nd molar. However, there was no significant association between the 3rd molar eruption status and caries on distal surface of 2nd molar (p=0.796) (Table 1).

Table 1. Association of mandibular 3rd molar status with caries on distal surface of 2nd molar.

Caries on Distal Surface of Mandibular 2 nd Molar	Mandibular 3 rd Molar Status				p-value
	Impacted		Erupted		
	N	%	N	%	
Caries Absent	552	61.4	1099	60.9	0.796
Caries Present	347	38.6	706	39.1	

Among the total impacted mandibular 3rd molars, mesioangular was most common type (41.3%), followed by horizontal (26.3%), vertical (19.7%) with least being distoangular (12.7%). With respect to Pell and Gregory classification, level B was the most common type (44.3%) followed by level A (38.6%). Class II was the most common type (57%) and class III was the least common type (17.7%) (Table 2).

Table 2. Distribution of mandibular 3rd molars status according to Pell and Gregory classification and Winters Classification.

Variables	Categories	N	%
Position of Mandibular 3 rd Molar	A	347	38.6
	B	398	44.3
	C	154	17.1
Class of Mandibular 3 rd Molar	I	228	25.3
	II	512	57.0
	III	159	17.7
Winter's Classification of Mandibular 3 rd Molar	Mesioangular	371	41.3
	Distoangular	115	12.7
	Horizontal	236	26.3
	Vertical	177	19.7

A subgroup analysis was performed among the impacted mandibular 3rd molars to evaluate the relationship of Pell and Gregory and Winter's classifications with caries on distal surface of mandibular 2nd molar. No significant association was seen between mandibular 3rd molar position and caries on distal surface of 2nd molar (p=0.076). The proportion of class III mandibular third molar associated with caries on distal surface of mandibular 2nd molars was significantly less than class II and I mandibular third molars (p=0.043). Poisson regression showed that class III M3M's were associated with lower risk of caries on distal surface of mandibular 2nd molar (PR=0.71; p=0.05)

when compared to class I. As per Winter's classification, except vertical type of impaction all the other types were significantly associated caries on distal surface of 2nd molar ($p < 0.001$). Poisson regression analysis showed that mesioangular ($PR = 1.57$; $p = 0.008$) and horizontal ($PR = 1.83$; $p = 0.001$) showed a significant higher risk of caries on distal surface of mandibular 2nd molars (Table 3).

Table 3. Association of caries on distal surface of mandibular 2nd molar with position, class and angulation of 3rd molars.

Variables		Mandibular 2 nd Molar Caries on Distal Surface				p-value [†]	PR (95% CI)	
		Absent		Present			p-value [‡]	
		N	%	N	%			
Position	A	206	59.4	141	40.6	0.076	1	-
	B	239	60.1	159	39.9		0.98 (0.78-1.23)	0.883
	C	107	69.5	47	30.5		0.75 (0.54-1.05)	0.089
Class	I	129	56.6	99	43.4	0.043	1	-
	II	313	61.1	199	38.9		0.9 (0.7-1.14)	0.368
	III	110	69.2	49	30.8		0.71 (0.5-0.99)	0.05
Winters	Mesioangular	223	60.1	148	39.9	<0.001	1.57 (1.12-2.19)	0.008
	Distoangular	71	61.7	44	38.3		1.51 (0.99-2.28)	0.054
	Horizontal	126	53.4	110	46.6		1.83 (1.3-2.59)	0.001
	Vertical	132	74.6	45	25.4		1	-

†P-value from Chi-square test; ‡P-value from Poisson regression; PR = Prevalence ratio.

Discussion

Impacted teeth are designated as teeth, which fail to erupt in their anatomic position within expected time duration [13]. Third molar impaction is the most frequent finding with prevalence in mandibular over maxillary teeth [14,15]. Impacted third molar behave differently than other teeth in the oral cavity. They are last in the chronologic eruption sequence associated with highest rate of developmental anomalies. The common reason being improper angulation of the long axis of the tooth in relation with the second molars or tooth size and arch length incongruity [16].

Impacted third molars are often associated with pathologies like pericoronal abscess, cysts and unicystic ameloblastoma. Besides these pathologies, incidence of distal caries in second molar is of utmost concern as the later bears the maximum masticatory load [16-18].

Hence there is consistent debate over the prophylactic removal of third molars to preserve second molars. Two schools of thought exist regarding removal of third molar. The preferential way being presence of pathology as menial as pericoronitis, localized periodontitis, caries on distal surface of second molar, root resorption of adjacent tooth; to severe disease outcome in the form of cyst, tumors and manifestation of systemic disease. The second school of thought advocates prophylactic removal of third molar, as prevention is better than cure. Justification given for the prophylactic removal is minimizing the risk of cyst and tumor development, reduced probability of mandibular angle fracture, ease of surgery, better healing of extraction site at younger age and no comorbidity to second molars [15,19,20].

Development of cervical caries on the distal aspect of mandibular second molar due to impacted third molar is of prime concern to endodontists [4]. Partially erupted third molars that are

in close approximation with the cemento-enamel junction (CEJ) of mandibular second molar and pose higher risk of development of occult caries in the later which can infect pulp in no time [4,7,20]. This complication often leads to the extraction of both teeth [21].

In view of above concern, this study evaluated the association of impacted mandibular M3M with CODS of mandibular M2M with help of retrospective panoramic radiograph survey. The overall prevalence of CODS on M2M was 38.9% (n=1053). This was similar to observed in South Africa [22] but much higher than that reported from the previous studies [1,5,23]. Similarly, the prevalence of CODS on M2M associated with impacted M3M (38.6%), which was also higher than the other studies reported previously [4-6,10]. These differences in the prevalence rate of CODS on M2M could be due to the fact that survey site is a tertiary care health center which provides treatment to all the complex cases that couldn't be treated elsewhere and eventually referred to higher centers for appropriate treatment and management. Cultural differences like oral hygiene habits, the socioeconomic level, diagnosis methods, awareness and utilization of available dental services in the vicinity also play a major role in the variations that were seen with the above prevalence rates.

In this study, there was no association of eruption status M3M with CODS of M2M. However, the subgroup analysis of the impacted 3rd molars showed that CODS of mandibular 2nd molar was more when they were associated with class I, II, mesio-angular and horizontal impacted mandibular 3rd molars. This was similar to the previous studies, which showed a significant association with partially erupted M3M [5], mesial angulation [1,4-6], and horizontal angulation [6] with presence of CODS mandibular 2nd molars. This could be due to the close approximation of mandibular 3rd molars with the CEJ of the second molars on the distal surface, which increases the food impaction and difficulty in maintaining the oral hygiene. Presence of specific strains around third molars have also been reported, which may accelerate localized periodontitis and development of cervical caries on distal surface.

Several other factors that were studied in the past such as, angulation of 3rd molars and distance between mandibular 2nd and 3rd molars showed significant association with CODS of mandibular 2nd molars. However, in this study such factors could not be incorporated as only orthopantomograms (OPGs) were screened. One of the limitations of this study was the use of OPG alone for the diagnosis of caries rather than clinical examination and auxiliary diagnostic methods like periapical radiograph. Owing to the study design and large scale data, these limitations would be inevitable.

Conclusion

Surgical removal of mandibular third molar is not universally accepted but should be considered when there is a possibility of developing caries, periodontitis or pericoronitis. Prophylactic removal cannot always be indicated or justified and should consider numerous factors as no association was found with eruption status of mandibular third molar and CODS of second

molars. However mandibular second molars that were associated with class I, II, mesio-angular and horizontal impacted mandibular third molars had significantly higher risk of caries on distal surface. Hence, it is indispensable to distinguish high-risk patients who are susceptible to development of distal caries in mandibular second molar in order to formulate a strict screening and follow-up protocol permitting for an early diagnosis of this pathology. Moreover depending on the prevalence of this pathology, a discussion regarding the prophylactic extraction of selected cases might be necessary.

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