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A comparative study on radiographic analysis of impacted third molars among three ethnic groups of patients attending AIMST Dental Institute, Malaysia

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ABSTRACT

Background: The patterns of facial growth, jaw and tooth size are inherited and are likely to differ among population and races. Aim of this study is to evaluate and compare the pattern of third molar (3M) impaction among three different ethnic groups (Chinese, Indian, Malay) of patients attending AIMST Dental Institute, Malaysia.

Materials and Methods: Dental records and orthopantomographs of 2200 patients aged between 20 and 40 years were retrieved and examined retrospectively. Wherever impacted 3Ms were present, the status of 3Ms, their location, the level of impaction and angulations were recorded and analyzed using STATDISK (version 10.4) and the values obtained were compared with least square distance of 0.05 level.

Results: About 667 radiographs met with the inclusion criteria and showed the presence of 1008 impacted 3Ms. On overall comparison the incidence of level B impactions were found to be higher in our study. Level A impactions were frequently seen in Chinese (41.9%), level B in Indian (36.4%) and level C impactions had an equal distribution among Chinese and Malays (34.1%). The difference was highly significant ($P \geq 0.05$). Mesioangular impaction (49.8%) followed by distoangular (22.9%) were the most common impactions among all the three races.

Conclusion: On comparison, mesioangular impaction was found to be the most frequent among all the three races whereas differences were seen in levels of impaction to some extent among the ethnic groups. But as a limitation, our findings and results reflected the status of 3Ms of patients attending AIMST Dental Institute, not entire Malaysia. Therefore more similar studies have to be carried out in other parts of Malaysia to substantiate our present findings.

Key Words: Impaction, racial study, radiography, third molar

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INTRODUCTION

The diverse nature of third molars (3Ms) continues to attract more attention than any other tooth in the oral cavity. Being last teeth to erupt they possess high chance for getting impacted. 3Ms are interpreted as impacted when they fail to erupt in the dental arch within the expected period of time[1] and therefore may persist as non-functional, abnormal or pathological.[2,3] It is evident through previous studies[4-8] that impacted 3Ms exhibit varied nature in terms of frequency, pattern and distribution among different population of the world. The overall prevalence of 3M impaction ranges from 16.7% to 68.6%.[4,9-17]

The appearance of face, the most variable part of human body is influenced by age, sex, culture and ethnicity.[18] It is generally accepted that patterns of

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facial growth, jaw and tooth size are inherited and are likely to differ among population and races.[19] Interestingly, as racial differences affect the pattern of impaction,[4,20,21] in this study we aimed to evaluate and compare the pattern of 3M impaction among three different ethnic groups (Chinese, Indians and Malays) of patients attending AIMST Dental Institute, Malaysia. To best of our knowledge this is the first comparative study done among ethnic groups of Malaysia with respect to various parameters of 3Ms.

MATERIALS AND METHODS

This study included retrospective review of clinical records and panoramic radiographs of 2200 consecutive patients who attended the Primary Care Clinic at AIMST Dental Institute, between June 2008 and December 2009. Demographic details of patients were obtained from clinical records.

In the study, lower age limit of patients was selected as twenty. As jaw growth gets completed by seventeen years,[22] at the age of twenty it is possible to differentiate whether the 3Ms had insufficient space or improperly positioned for normal eruption.[23] The upper age limit was selected as forty, since beyond this age, presence of 3Ms are unlikely due to the rising incidence of pathologies associated with them (caries, pericoronitis, periodontitis or tumors), which necessitates their removal.

The patient's records or orthopantomographs (OPGs) satisfying the following conditions were included in the study:

1. All OPGs with first and second molars appropriately aligned in the arch.
2. All erupted 3Ms with completed root formation.
3. All impacted 3Ms with completed root formation.

The patients with any of the following conditions were excluded from the study:

1. 3Ms with incomplete root formation
2. Grossly decayed 3Ms with spatial relationships difficult to assess
3. Mesially drifted 3Ms due to loss of second or first molars
4. Mesially drifted second molars due to loss of first molar
5. Pathosis or trauma to the jaws that may disrupt the teeth alignment
6. Dental anomalies and congenital diseases like paramolars, Down's syndrome etc.
7. Clinical records without OPG

Four examiners in two groups reviewed the OPGs in a semi-darkened room using identical X-ray viewers. The status of 3Ms (whether erupted or impacted), their location in the arch (mandible or maxilla), the level of impaction and their angulations were determined as follows:

Status of 3Ms (erupted or impacted)

Radiographically, teeth were considered impacted when their eruption to normal functional occlusion has been interfered by other teeth or by overlying bone/soft tissue and it is not fully erupted by its expected age at around 20.[23]

Level of impaction

The level of impaction of the 3M was classified based on Pell and Gregory classification:[24]

i) Level A: When the most superior part of 3M is at or above the level of occlusal plane of second molar [Figure 1].
ii) Level B: When the most superior part of 3M is between the level of occlusal plane of second molar and its cervical line [Figure 2].
iii) Level C: When the most superior part of 3M is below the cervical line of second molar [Figure 3].

Angulation of impaction

Angulations of impacted 3Ms were recorded based on Winter's classification.[25] According to the position of impacted 3M to the long axis of the second molar, classification was done as mesioangular, horizontal, vertical, distoangular, buccolingual (transverse). Rare angulations like mesioinverted, distoinverted were grouped as 'others'. Measurement of angulations of 3Ms were determined by tracing panoramic radiographs with reference to the angle formed between the intersected longitudinal axes of the second molar and the 3M [Figure 4], with the help of protractor as suggested by Quek, *et al.*[4] [Table 1]. To ensure diagnostic reproducibility, only 25 OPGs were reviewed by a group in a day. The measurements were done by one of the examiners of a group, which was cross checked randomly by the second examiner

Table 1: Measurement of angulations

Level of impaction	Angulation of 3rd molar in relation to 2nd molar
Vertical impaction	10° to –10°
Mesioangular impaction	11° to 79°
Horizontal impaction	80° to 100°
Distoangular impaction	–11° to –79°
Others	111° to –80°
Buccolingual impaction	

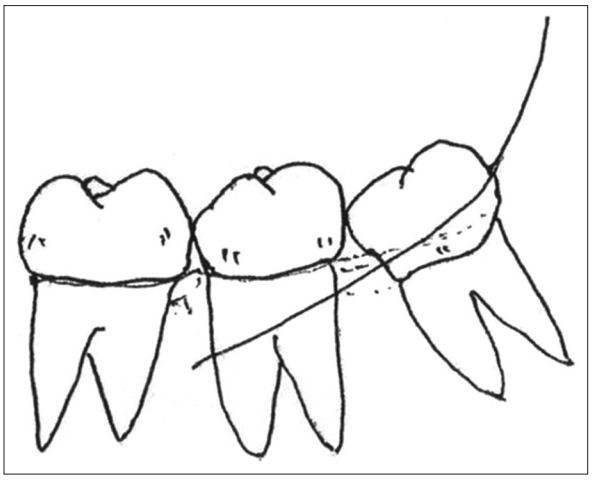

Figure 1: Level A impaction

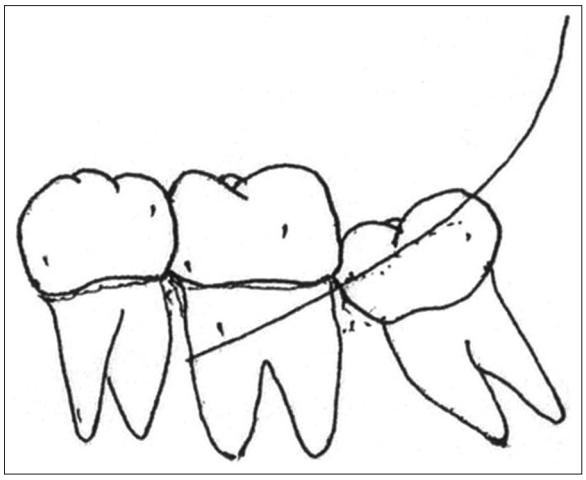

Figure 2: Level B impaction

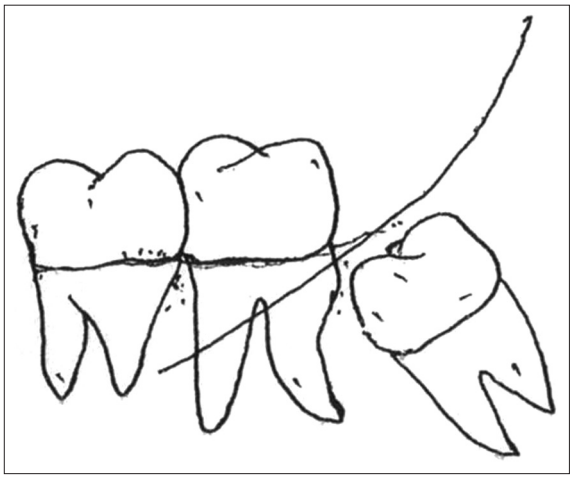

Figure 3: Level C impaction

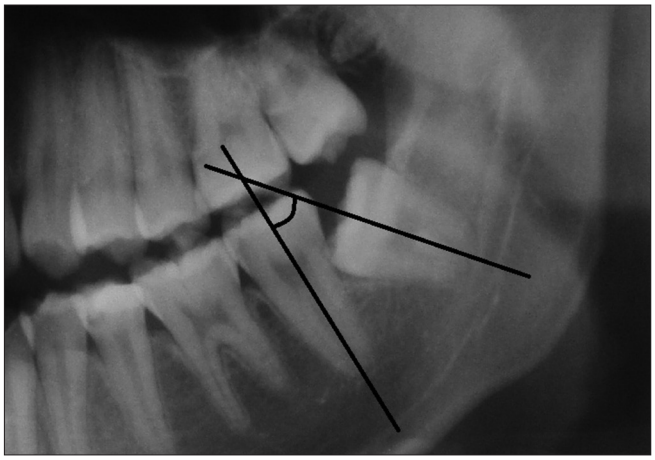

Figure 4: Measurement of angulation of third molar on panoramic radiograph

of the same group. The whole process was repeated when inter-examiner error was more than 10%. Values were entered only when both the examiners of a particular group agreed with each other.

Ethical clearance for the study was obtained from AIMST University Human and Animal Ethics Committee. All data regarding patient identification and radiographic findings were kept confidential. The data were subjected to statistical analysis using STATDISK (version 10.4) and the values obtained were compared with least square distance of 0.05 level.

RESULTS

Of the 2200 OPGs, 667 radiographs of 216 Chinese, 229 Indians and 222 Malays who met with the inclusion criteria were studied. The average age of patients evaluated was 28.2 years. Out of 667 radiographs, 216 presented with completely erupted 3Ms and therefore not taken into consideration for further study. A total of 451 (67.6%) patients presented with at least one impacted 3M, which included 175 (38.8%) Chinese, 138 (30.6%) Indians and 138 (30.6%) Malays. The distribution of patients with impacted and erupted 3Ms among all the three races was statistically highly significant [Table 2].

The total number of impacted teeth among 451 patients was found to be 1008. Chinese (especially females –21.8%) and Malays (especially males –11.1%) showed the most and least impacted teeth, respectively, when compared with other races; however, statistically the significance value is greater than the computed x^2, which showed that there is no significant difference between the genders [Table 3].

Mesioangular impaction (49.8%) followed by distoangular (22.9%) were the most common

Table 2: Distribution of patients with impacted and erupted third molars among different races

	Chinese (%)	Indian (%)	Malay (%)	Total (%)	Computed value (x^2)	Significance	Probability p
Erupted	41 (19.0)	91 (42.1)	84 (38.9)	216 (100)	26.390	5.99	0.000
Impacted	175 (38.6)	138 (30.7)	138 (30.7)	451 (100)			

Significance at 0.05 level

Table 3: Percentage distribution of impacted third molars according to different races in males and females

Gender	Chinese (%)	Indian (%)	Malay (%)	Total (%)	Computed value (x^2)	Significance
Male	165 (16.4)	143 (14.2)	112 (11.1)	1008 (100)	5.005	5.991
Female	220 (21.8)	174 (17.3)	194 (19.2)			

Significance at 0.05 level

Table 4: Distribution of angulations of impaction among the three races

	Chinese (%)	Indian (%)	Malay (%)	Total (%)
Vertical	58 (31.3)	63 (34.1)	64 (34.6)	185 (18.4)
		185 (100)		
Mesial	214 (42.6)	144 (28.7)	144 (28.7)	502 (49.8)
		502 (100)		
Horizontal	26 (41.3)	23 (36.5)	14 (22.2)	63 (6.3)
		63 (100)		
Distal	72 (31.2)	81 (35.0)	78 (33.8)	231 (22.9)
		231 (100)		
Others	1 (14.3)	4 (57.1)	2 (28.6)	7 (0.7)
		7 (100)		
Buccolingual	12 (60.0)	2 (10.0)	6 (30.0)	20 (1.9)
		20 (100)		
Total				1008 (100)
Computed value (x^2)		16.37		
Significance		0.0894		

Significance at 0.05 level

impactions among all the three races and it differed significantly [Table 4]. Mesioangular impactions were more common in Chinese (42.6%) followed by Indians and Malays who had equal distribution (28.7%). Distoangular impactions were more common in Indians (35.0%) and least common in Chinese (31.2%). Vertical impactions showed almost equal distribution among all the three races. Horizontal impactions were least common among all the races particularly in Malays (22.2%).

As it was difficult to classify the level of bucco-lingually impacted molars, out of 1008 impacted molars, 20 bucco-lingually impacted molars were not considered in the evaluation of level of impaction. The remaining 988 impacted molars were considered for evaluation.

Among the races, impactions at Level B (41.4%) were found to be higher followed by Level A (40.8%) and Level C (17.8%). Level A impactions were frequently seen in Chinese (41.9%) while Level B, in Indians (36.4%) and Level C impactions had equal distribution among Chinese and Malays (34.1%). Besides this, Level A and Level B impactions were more common in mandible whereas Level C impactions were interestingly found to be more common in maxilla than mandible in all the races. Statistically the computed value is greater than the significance value at 0.05 level, indicating a significant relation in the level of impaction among the three races [Table 5].

DISCUSSION

3Ms follow abortive eruption path and get impacted as a result of skeletal insufficiency in the area where they normally erupt. Their etiologies remain multifactorial.[26-28] They are unique from other teeth in the jaws exhibiting interestingly variable patterns of eruption. Though literature review[4-8] presents many studies on the prevalence of impacted 3Ms in different countries, comparative studies among ethnic groups (races) in terms of 3Ms are not currently done in Malaysia.

In Peninsular Malaysia, there exist three major races namely Malays, Chinese and Indians. Apart from Indians who belong to the sub-group of Caucasoid called Indo-Dravidian (Indo-European), all others belong to Mongoloid race.[29] This study evaluated and compared various parameters of 3M impaction among individuals of the three main ethnic groups of Malaysia, as such studies are essential for better understanding of basic mechanisms involved in their eruption.

In our study, 67.6% of the 667 OPGs had at least one impacted 3M. This result is quite similar to the frequency (65.6%) of impacted 3Ms in a study by Morris and Jerman on 5000 subjects in USA.[30]

Table 5: Distribution of impacted third molars by level of impaction

Level of impaction	Chinese (%)		Indian (%)		Malay (%)		Total (%)
	Maxilla	Mandible	Maxilla	Mandible	Maxilla	Mandible	
A	6 (1.5)	163 (40.4)	2 (0.5)	108 (26.8)	4 (1.0)	120 (29.8)	403 (40.8)
	169 (41.9)		110 (27.3)		124 (30.8)		
			403 (100)				
B	53 (13.0)	89 (21.8)	63 (15.4)	86 (21.0)	36 (8.8)	82 (20.0)	409 (41.4)
	142 (34.8)		149 (36.4)		118 (28.8)		
			409 (100)				
C	48 (27.3)	12 (6.8)	39 (22.2)	17 (9.6)	44 (25.0)	16 (9.1)	176 (17.8)
	60 (34.1)		56 (31.8)		60 (34.1)		
			176 (100)				
Total							988 (100)
Computed value (x^2)				7.916			
Significance				0.095			

Significance at 0.05 level

A study by Quek and Tay, *et al.*[4] too reported similar frequency (68.6%) of impacted 3Ms in their study of 1000 OPGs in Singapore Chinese population.

When compared among races [Table 2], our study showed higher frequency of 3M impactions in Chinese. The reason for this could be tooth-jaw size discrepancy and tapered arch form in Chinese as put forward by Keng and Foong.[31] According to them Chinese arch is more tapered with wider inter-molar width which less favorably disposes to resorption of ramus. This provides insufficient space for eruption of 3Ms thereby increasing the frequency of their impaction more in mandible than in maxilla.

The current study showed significantly higher frequency of impacted 3Ms in females than males and in mandible than maxilla in all the three races [Tables 3 and 4]. The cessation of jaw growth when 3Ms begin to erupt could be the possible reason for occurrence of more impacted 3Ms in females. This differs in males where growth of jaw continues beyond the time of eruption of 3Ms as proposed by Hellman.[23]

Mesioangular followed by distoangular impactions were the most common impactions in all the three races in our studied population [Table 4]. A similar result was reported by Anwar, *et al.*[32] where mesioangular impaction was found to be most frequent. The possible reason for high occurrence of mesioangular impaction could be due to differential growth seen between mesial and distal roots of 3Ms. Depending on the proportion of the root development, underdevelopment of the mesial root results in mesioangular impaction, and overdevelopment of the same root may result in distoangular impaction.[33] Normal rotation of 3Ms are expected to occur from horizontal to mesioangular and from mesioangular to vertical. Failure of rotation from mesioangular to vertical position is very common resulting in more mesioangular impactions.[33]

The level in which impacted tooth is positioned gives an idea about the depth of the tooth buried and helps the surgeon in treatment planning. Our study revealed presence of more impacted teeth in Level A in Chinese mandible. Teeth in Level B were found slightly higher in Indian mandible when compared with Chinese. In maxilla, these proportions were different, as Level C was found to be more common in all the races [Table 5].

CONCLUSIONS

Even though facial features, jaw width and tooth size differs among races, interestingly in present study, the most common angulation registered was mesioangular in all the three races and slight differences were seen in levels of impaction among the different ethnic groups. But as a limitation, our findings and results reflect the status of 3Ms of patients attending AIMST Dental Institute, not entire Malaysia. Therefore more similar studies need to be carried out in other parts of Malaysia to substantiate present findings.

As comparisons among races of Malaysia in terms of 3Ms were not reported in literature, the results and findings obtained in this study may be helpful for researchers with similar interest to carry out further study in this field.

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