Pattern of Mandibular Third Molar Impaction in Malaysia Population and Their Association with Gender, Age and Race

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Abstract

The third molar tooth is the most commonly impacted. The prevalence varies with different population and regions. This study evaluated the association between race, age, gender and also the retromolar space with the incidence of the mandibular third molar impaction among Malaysian population. A hundred twenty nine consecutively treated patients in local dental clinics were entered into the study. By considering the influence of age, sex, and race, the subjects were divided into impacted and non-impacted group based on the occlusal level of mandibular third molar by means of digital vernier caliper measurement. The orthopantomogram of these patients were examined to find out the presence/absence of the mandibular third molars and the type of impaction and the angulations, if presents. Interestingly, Indian race are found to have the highest incidence (2×) of mandibular third molar impaction in Malaysian population, followed by Malay and Chinese without any bias in gender. The age group with the highest incidence of mandibular third molar impaction is between 28-33 years old. Our findings also demonstrated strong relationship between the retromolar space and mandibular third molar impaction incidence. The commonest type of angulations seen in impacted group is mesioangular. The incidence of mandibular third molar impaction was also found to be associated with the age group, gender and race of the patient.

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Introduction

Early diagnosis of the mandibular third molar impaction is a crucial part of the comprehensive dental treatment planning. In orthodontic terms, an impacted tooth is simply a tooth that completely or partially unerupted into the dental arch resulted in extreme discomfort and other unpleasant symptoms.[1] Tooth impaction on mandibular third molars is the most frequently encountered in routine dental practice. Generally, mandibular third molars will normally erupt at ages ranging from 18-24 years old if they are in an appropriate occlusion. However, about 40% of the cases are partially or completely impacted. [2-5] Third molar impaction or eruption is an important clinical issue because retention of this tooth might be beneficial for orthodontic anchorage, prosthetic abutments, or transplantation. Among the factors that may cause impacted third molar are: inclinations and mesiodistal crown widths of the mandibular molars, vertical and horizontal spaces between the distal surface of the second molar and the anterior surface of the ramus, lengths and widths of the mandibular ramus and body, the ramus inclination, the mandibular plane angle, and the mandibular gonial angle.[5] The main cause of third molar impaction has been suggested to be due to inadequate space between the distal second mandibular molar to the anterior border of the ramus which referred as 'retromolar space'.[6-8]

On the other hand, racial variation, nature of diet, degree of use of masticatory apparatus, and genetic inheritance could affect the jaw size and tooth size; hence prevalence and incidence

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of impacted third molars varies for different population groups.[9] A study byHattab, Ma'amon [8] showed that there is no effect of gender on the length of retromolar space of females (11.13 ± 2.55 mm) and males (10.96 ± 2.77 mm) in the impacted group of Jordanian students. The author had also concluded that the retromolar space was significantly smaller in the impacted group compared to the erupted group and if the retromolar space/crown width ratio was ≥ 1, significantly more third molars had erupted. However, about 17% of the third molars failed to erupt even when retromolar space was adequate. In contrary,Sandhu and Kaur [9] reported that the retromolar space in Asian-Indian population are significantly larger in males (16.28 ± 2.49 mm) when compared to females (14.91 ± 3.11 mm) with impacted mandibular third molar. The author had also demonstrated that despite the significance between the retromolar spaces with the gender, there are significant difference between the right and left sides of the mandible with respect to retromolar space.

Little information was known regarding the root canal anatomy and morphology of the mandibular premolars in the Malaysian Population. Therefore, the main goal of this study is to evaluate the retromolar space/area with the impaction incidence of the mandibular third molar in Malaysian population and its association with race, age and gender. The length of the retromolar space in a group with impacted mandibular third molar and in another group with non-impacted mandibular third molar was also recorded. Finally, the most frequent type of mandibular third molar impaction angulation was determined.

Materials and methods

This is an institutionally approved retrospective study that have been carried out by evaluating the data including age, sex, race and the orthopantomogram of a total of 129 patients from MAHSA Dental Clinics, Malaysia. We use the panoramic radiography among other radiographic techniques to assess lower third molar space and mandibular linear dimensions and angles, because it yielded one of the most accurate estimates according to literature. [10-13] The inclusion criteria for the subjects are patients (a) in age group between 18 to 50 years old, (b) free from any systemic or pathological diseases affecting the bone quality or quantity (eg. Paget's disease), (c) diagnosed with the presence of mandibular third molar and had not previously undergone orthodontic treatment. The exclusion criteria are patients below 18 or above 50 years old, (b) with systemic or pathological diseases that affects bone quality or quantity, (c) had extracted or congenitally missing mandibular third molar and (d) had previously undergone orthodontic treatment.

The subjects are divided into two main groups: Group A- Patients with impacted mandibular third molar group (impaction group, Figure 1a) and Group B- Patients without impacted mandibular third molar impaction (non-impaction group, Figure 1b)). This grouping is based on the occlusal surface of mandibular third molar. Impacted group has occlusal surface of mandibular third molar lies below or at the horizontal line formed between mesial and distal of the Cementoenamel Junction (CEJ) of mandibular second molar. Non-impacted group, on the other hand, has occlusal surface of mandibular third molar lies above the horizontal line formed between mesial and distal of the CEJ of mandibular second molar.

The quantitative data collected is the length of retromolar space (in millimeter). The method of measuring the retromolar space is by drawing two imaginary lines (Line A & Line B) on the orthopantomogram which represents the occlusal plane and retromolar area (Figure 1c). The imaginary line of occlusal plane (Line A) was drawn from the tip of the mandibular canine cusp to the distobuccal cusp of the mandibular second molar. Another imaginary line of the retromolar space (Line B) was drawn parallel to the occlusal plane, from the most bulging point of the distal border of mandibular second molar to the anterior border of the ramus. This imaginary line of retromolar space was measured using a digital vernier caliper. The measurements obtained from the caliper were then divided by 1.25 which is the magnification value of the x-ray. The length unit is in millimeters (mm) and two decimal points were taken.

The angulation type of mandibular third molar was also determined in this study by using the Winter's classification.[14, 15] The classification is based on the inclination of the impacted wisdom tooth (3rd molar) to the long axis of the

2nd molars as shown in Table 1. All the measurements were recorded by one author and then reconfirmed by the author for reliability of data, which was then analyzed with independent t- test.

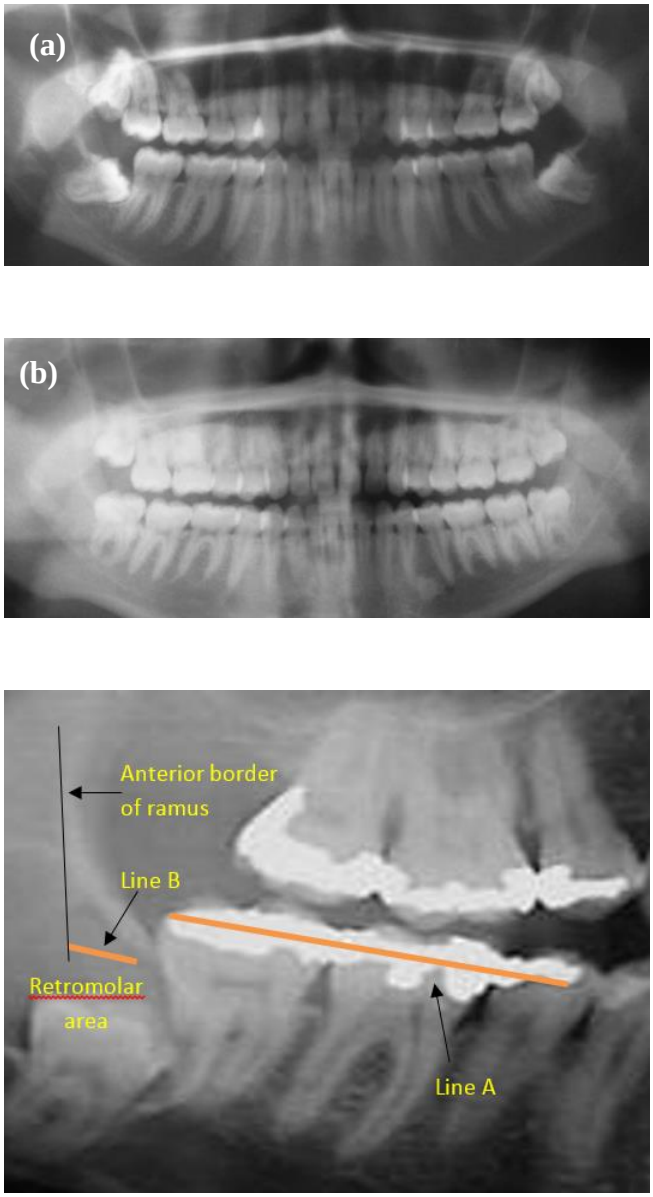

Figure 1: Representative orthopantomogram images of (a) impacted and (b) non-impacted mandibular teeth with (c) imaginary line A and line B was drawn to measure the length of retromolar space in impacted group.

Classification	Description
Mesio-Angular	The impacted mandibular third molar is tilted toward the second molar in a mesial direction.
Disto-Angular	The impacted mandibular third molar is tilted distally from mandibular second molar.
Horizontal	The long axis of the impacted mandibular third molar is perpendicular to the long axis of the second molar.
Vertical	The long axis of the mandibular third molar is parallel to the long axis of the second molar
Transverse	Impacted mandibular third molar is in absolutely horizontal position in a buccolingual direction. The crown can be facing buccally or lingually.
Inverse	The impacted third molar is in an upside down position with the crown facing downwards.

Table1. Determination of the angulation type of mandibular third molar by the Winter's classification[14,15].

Results

The sample was composed of 129 patients and the incidence of having at least one impacted mandibular third molar was found to be 35 cases (27.13%), regardless of the gender. Figure 2 shows the distribution of impactions in different race groups. Interestingly Indian group has the highest prevalence of impacted cases (41.9%) that is almost two times the incidence of impaction found in Chinese (21.2%) and Malay (24.6%) groups.

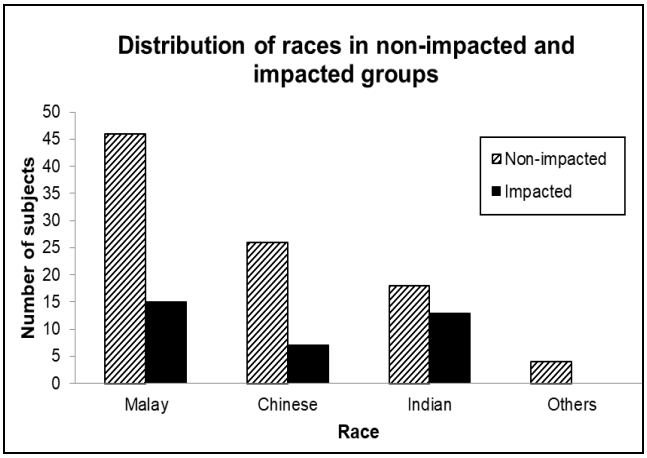

Figure 2. Bar chart shows distribution of races in non-impacted and impacted group.

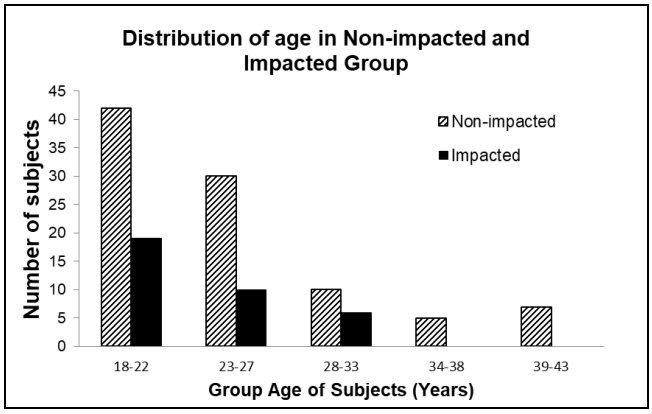

Figure 3. Bar chart shows distribution of age groups in non-impacted and impacted group.

Figure 3 shows the distribution of age by the total number of impacted third molars. The higher incidence of mandibular third molar impaction in patient of middle age ofbetween28-33years old (37.5%) is recorded which then followed by 18-22 (31.1%) and 23-27(25.0%) age group. Meanwhile, there is no incidence of impaction were found in the subjects more than 34 years old due to limited sample size. The distribution of impacted third molars by sex is shown in Figure 4. Although, there are more females (94 patients) than males (35 patients) in both non-impacted and impacted groups, the percentage of patient with tooth impaction in males group are relatively higher (71.4%) when compared to female (61.7%). However, the total number of impactions was not significantly different between the sexes (p> 0.05).

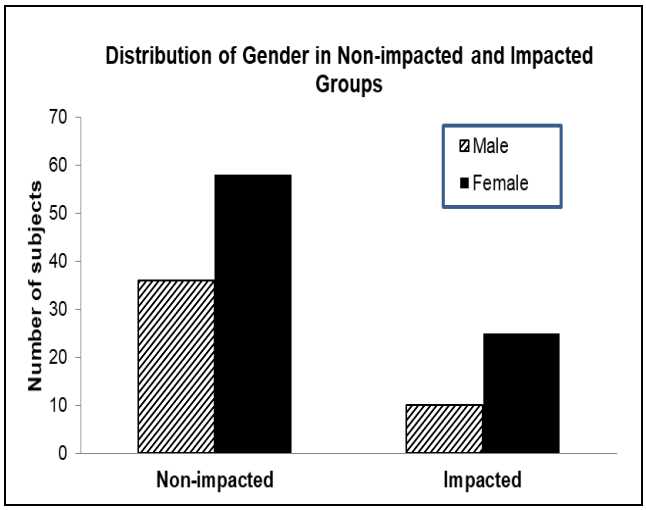

Figure 4. Bar chart shows distribution of gender in non-impacted and impacted groups.

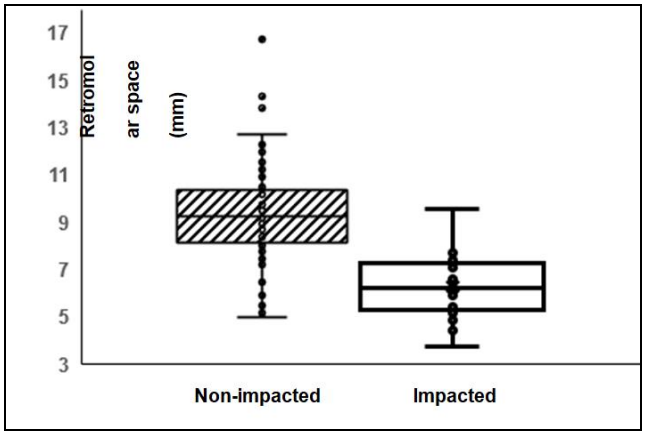

Figure 5. The relationship between distance between distal of mandibular second molar and the anterior border of ramus (mm) and mandibular third molar impaction.

Figure 5 revealed the distance between distal of mandibular second molar and the anterior border of ramus (mm) or retromolar space and the incidence of mandibular third molar impaction. Interestingly, the average length of retromolar space measured in the non-impacted group (9.311 ± 2.05 mm) is significantly higher (p< 0.001) when compared to the average length of retromolar space for impacted group (6.282 ± 1.20 mm). Of the 35 impactions, mesioangular (57%) is the most common type of angulation, followed by horizontal (31%), vertical (9%), and transverse (3%) impactions (as shown in Figure 6).

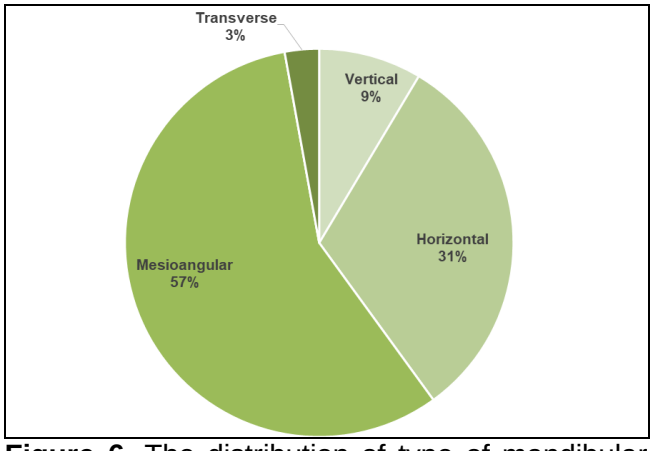

Figure 6. The distribution of type of mandibular third molar angulation in non-impacted and impacted groups. There is no distoangular impaction found.

Discussion

Malaysia is a multiracial country which composed 4 main ethnic groups named as Malay, Chinese, Indian and others (Bumiputera Sabah/Sarawak). As racial variation with a spectacular mix of people, traditions and culture, nature of diet, and degree of use of masticatory apparatus affect the jaw size and tooth size. In this study, we have looked into the incidence of mandibular third molar impaction in different age group, race, gender and the angle of impaction. Among the four races (Malay, Chinese, Indian, others), Indian has the highest percentage in impacted groups. This result, however, depends on the availability of our subjects which are taken randomly according to the inclusion and exclusion criteria.

As for the gender-related factor, the prevalence of tooth impaction incidence among the males (71.4%) is relatively higher than females (61.7%) with no significant difference ($p > 0.05$). These data is in agreement with the observation made by Dachi and Howell[16] and Kramer and Williams[17]. However, it is not coincided with a study conducted by Hellman[18] who reported significantly lower incidence in males (9.5%)when compared to females (23%). The author proposed that females exhibit higher frequency of third molar impaction as their jaws stop growing at the time when third molars begin to erupt whereas the growth continues beyond the time of third molar eruption in the males. Needless to say, more subjects are required in order to obtain the significance difference between two groups and in order to approve or disapprove the statements.

The highest number of age group in both non-impacted and impacted group is between 28 and 33 years old. The reason for this might be because of the availability of the subjects and inclusion criteria. Most of the cases with age above 34years old have been excluded because they had orthodontic treatment done or had their mandibular third molar removed. Other reason of not getting the availability of subjects in older age is because of the loss of one or a few of their mandibular teeth. Generally, it is difficult to distinguish tooth impaction at the age of below 20 years old because of continuous positional changes of the teeth and growth of the jaws (completed by the age of 17 years).[19] It was also proposed that the appropriate age for the subject to study the frequency and pattern of third molar impaction should be around 20–23 years old where a significant increase in angulations is often observed[20].Meanwhile, some changes in the angulation and position of third molars can be seen in older individuals and it was also observed that the teeth embedded in the ramus, horizontally impacted teeth, or teeth unerupted by 35 years old will tend to have impactions.

We had also recorded mandibular third molar angulation by mere observation, without measurement, to see the most frequent type of impaction in our research. According to Winter's classification, mesioangular (57%) impaction was the most common angular position followed by horizontal (31%), vertical (9%) and transverse (3%). Similar findings were obtained byHashemipour, Tahmasbi-Arashlow[21] and Quek, Tay[22] in which the mesioangular impaction was the most common. On the other hand, Gupta, Bhowate[23] and Hazza'a, Albashaireh[24] found that the highest number of impacted third molars was in vertical position, followed by mesioangular and distoangular. Meanwhile, Richardson[25] found that the highest incidence of impacted third molars was in horizontal position. There is no distoangular type of impaction seen in the impacted group. This might be due to limitation in the availability of subjects or it may be very rare to find a distoangular type of impaction in the Malaysian population. These results indicated that angular position of impacted third molars varies among population groups. This can be due to different classification criteria performed among authors. In our study, the angular position of third molars was determined by visual impression based on winter's classification. Meanwhile, in some studies, the angular position was determined by incorporating a system of measurements using a protractor. This method could avoid errors arising from visual impression, thus, ensure reproducibility of the results.[22]

In order to predict the occurrence of impaction or eruption of the mandibular third molars, various attempts have been made to establish pretreatment parameters for clinician guideline. Accordingly, researchers have taken into the consideration of the ''retromolar'' space between the second or first molars and the ramus to predict the tooth impaction. Although, it is generally logical to assume that higher incidence of crowding are associated with the lack of retromolar space, the predetermined

distances from the anterior border of the ramus of the mandible to the distal surface of mandibular second molar tooth can be varied across every population groups in the world. Data are lacking regarding the relationship between retromolar space and chance of tooth impaction in Malaysian population.

Based on our current findings, lack of distance between distal of mandibular second molar and the anterior border of ramus was found to be associated with the incidence of impaction in mandibular third molar among Malaysian population. The distance is about similar to a study by Ventä, Turtola[26] who recorded 11.1 ± 2.7 mm for the mean value of retromolar space in impacted patient for Finnish population, regardless of the gender. Meanwhile, a study by Qamruddin, Qayyum[27] on 140 Pakistani patients showed that the mean distance of retromolar space from anterior edge of ramus was relatively larger with 16.30 ± 2.51 mm for the non-impacted group and 11.21 ± 3.69 mm for impacted group. Another study by Hattab, Ma'amon [8] recorded a larger retromolar space in both impacted and impacted patient with mean of 14.05 and 12.15 mm, respectively. These studies support our result showing that the mean value of retromolar space in impacted group is less than the mean in non-impacted group.

However, it was found that for the minimum measurement in non-impacted group is 6.26mm which is almost equal to the mean value in impacted group. This means that in some cases with very less retromolar space, mandibular third molar can still erupt. Moreover, in impacted group, there is one case with the measurement of 11.96 mm, which is higher than the mean value for non-impacted group, showing that mandibular third molar can still be impacted although there is adequate retromolar space. This proved that retromolar space is not the only indication that the mandibular third molar will be impacted or erupted.[28] There are other factors that affect the impaction of mandibular third molar such as: inclinations and mesiodistal crown widths of the mandibular molars, vertical and horizontal spaces between the distal surface of the second molar and the anterior surface of the ramus, lengths and widths of the mandibular ramus and body, the ramus inclination, the mandibular plane angle, and the mandibular gonial angle.[29] Nevertheless,[8] with the result of 10.96 (± 2.77) mm in males and 11.13 (± 2.55) mm in females for the impacted group in Jordanian students, found that the 0.16 mm difference was not significant, which means there is no effect of gender on the length of retromolar area.

Conclusions

From our study, it can be concluded that the developmental formation of the mandibular third molars is associated with the race, age and available retromolar space. More females are found to have mandibular third molar impaction compared to males. There is a strong relationship between the distance from the anterior border of the ramus of the mandible to the distal border of mandibular second molar tooth with the impaction incidence of the mandibular third molar. The most frequent type of mandibular third molar impaction seen in our study is the mesioangular type. Although, the retromolar space is not the only factor affecting the incidence of the mandibular third molar impaction, there is positive correlation between an increased retromolar space and a higher chance of eruption.

Declaration of Interest

The authors report no conflict of interest and the article is not funded or supported by any research grant.

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