

Prevalence of Impacted Third Molars by Winter's Classification and Pell & Gregory's Classification on Radiographic Assessment in Relation to ABO Blood Group in Orthodontic Patients in Hospital Universiti Sains Malaysia (HUSM)

Yap Hao Zhi¹⁾, Che Ku Farah Najwa Che Ku Aziz¹⁾, Sanjida Haque¹⁾, Wan Suriana Wan Ab Rahman¹⁾, Mohammad Khursheed Alam²⁾

ABSTRACT

Objective: To determine the impaction of third molar tooth germs in relationship with the ABO blood group in orthodontic patients in HUSM.

Methods: 241 subjects (n = 241) were randomly selected from HUSM's orthodontic clinic. Patients blood group is determined using Tyle's method and orthopantomograph (OPG) is used to assess angulation of impaction according to Winter's classification and Pell & Gregory's classification. The data were analysed with Pearson's Chi-Square test.

Results: Most subjects had all 4 M3 impacted (32.8%), followed by 2 M3 impacted (29.0%), 3 M3 impacted (16.0%), no M3 impacted (11.2%) and only one M3 impacted (10.8%). Significant association is found between number of M3 impaction and genders. Blood group type A (94.1%) shows the highest prevalence to have at least one M3 impaction, followed by O (90.0%), AB (87.5%) and B (83.1%). The most common type of impaction based on angulation is mesio-angular in all 4 M3. No significant association was found between the ABO blood group and angulation of impaction as well as between ABO blood group and depth of impaction and M3 impaction relation to the anterior border of the ramus.

Conclusion: No association between impaction status and ABO blood group in orthodontic patients in HUSM.

KEY WORDS

impacted third molar tooth, Winter's classification, Pell & Gregory classification, ABO blood group, orthodontic patients

INTRODUCTION

The third molar (M3) is a tooth characterized by the variability in the time of its formation, its widely varying crown and root morphology, and its varying presence or absence in the oral cavity¹⁾. Impaction of one or more permanent third molar is a common anomaly in man²⁾. The wide range of prevalence of this anomaly might be attributed to the differences in the ABO blood group, methods of sampling and examination, age and sex distribution, and racial origin of the subjects.

A tooth was defined as impacted when the tooth was obstructed on its path of eruption by an adjacent tooth, bone, or soft tissue³⁾. An impacted tooth may be completely impacted, when entirely covered by soft tissue and partially or completely covered by bone within the bony alveolus, or partially erupted, when it has failed to erupt into a normal functional position³⁾.

Karl Landsteiner *et al.* 1901, introduces the first and most important system of blood grouping which is the ABO blood group⁴⁾. Besides that, Lewis *et al.* in 1978 stated that, there are two main antigens, A and B, in

the ABO system and the presence or absence of these antigens give an outcome of the four blood groups or blood types: A, B, AB, and O⁵⁾. The ABO blood group is known to have influence in some of the diseases. Sharma *et al.* did a study on association of ABO Blood Groups with malocclusion in population of Jaipur, India. They found that association of blood groups with malocclusion is highest in blood group B, followed by A, O and AB with the least prevalence. Blood groups B and A had the increased incidence of association with malocclusion while blood groups O and AB had decreased incidence of association with malocclusion⁶⁾. In contrast, a study of craniofacial morphology with genetic influence of ABO blood group in Malaysian Orthodontic patients reveals that type of malocclusion cannot be predicted in the respective blood group⁷⁾.

We hypothesized, there was no evidence to support that ABO blood group is associated with M3 impaction. By doing this study, we can predict the type of malocclusion that might present in certain blood group. Therefore, early treatment and intervention can be planned for the patient. The angulation of impacted third molars can be used as a guide to decide for its future. Orthopantomograph (OPG) is the radiograph

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1) School of Dental Sciences, Universiti Sains Malaysia
16150 Kubang Kerian, Kelantan, Malaysia

2) Orthodontic Department, College of Dentistry, Jouf University
Sakaka, Kingdom of Saudi Arabia

Correspondence to: Mohammad Khursheed Alam
(e-mail: dralam@gmail.com)

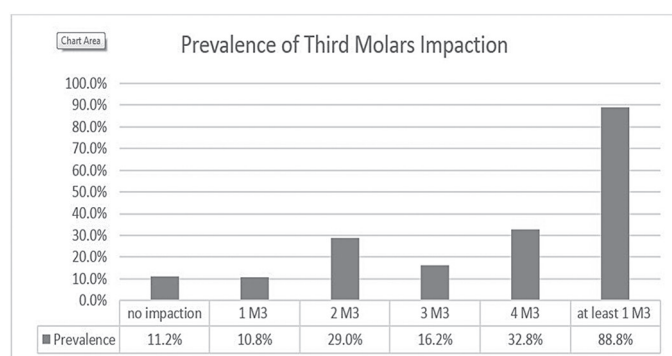


Figure 1. Prevalence of number of M3 impaction in total population

most commonly used for this purpose. The most commonly applied classification systems around the world for impacted third molar are Winter's and Pell & Gregory's classification. Based on hypothesis, the aim of this present study was to:

- (1) Examine the prevalence of impaction M3 among orthodontics patients in Hospital Universiti Sains Malaysia (HUSM).
- (2) Investigate the type of impacted M3 on both maxillae and mandible based on Winter's classification on the basis of OPG.
- (3) Investigate the type of impacted M3 on mandible based on Pell & Gregory's classification on the basis of OPG.
- (4) Determine the association of impacted M3 towards gender and ethnicity.
- (5) Examine the relationship of impacted M3 in comparison with ABO blood group.

METHODS AND MATERIALS

All participants provide their written informed consent (one of the parents, either father and/or mother gave written consent for the adolescent subjects). This study was approved by the Ethical Committee of the Hospital Universiti Sains Malaysia (HUSM), which complies with the Declaration of Helsinki. This study was designed and conducted according to the guidelines of strengthening the Reporting of Observational studies in Epidemiology (STROBE), and we applied the STROBE checklist in the preparation of this manuscript.

This cross-sectional study was conducted at orthodontic clinic of Hospital University Sains Malaysia (HUSM), to determine the association of M3 impaction with ABO blood group. Patients ages ranges from 18 to 30 years old. Digital images, orthopantomogram (OPG) of orthodontics patients from archive are analysed.

Sample size calculation:

Sample size is calculated using power and sample size software with a power of 80%; the alpha was 0.05. with sigma = 0.37

$$n = \frac{2\sigma^2}{\Delta^2} (z_\alpha + z_\beta)^2$$

n = number of sample

σ = SD from other study

Δ = Precision value

z_α = z-score at 95% confidence interval = 1.96

z_β = z-score at 80% confidence interval = 0.84

Considering the available resources, number of sample, n = 244. Also, considering 10% missing data of the sample is added, so the sample size is 271. Considering the available resources, number of sample, n = 210. Also, considering 10% missing data of the sample is added, the sample size is 231. Finally, two hundred forty one (n = 241) samples are collected from Orthodontics department of Hospital Universiti Sains Malaysia for our study.

Inclusion Criterion

1. Consented for this study.

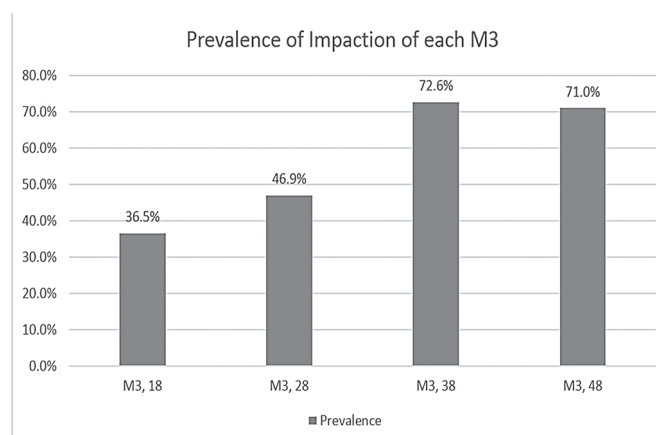


Figure 2. Prevalence of impaction of each M3 in total Population

2. All patients who received orthodontics check-up in dental clinic HUSM.
3. Patients ages between 18 to 30 years old
4. Those never undergoes orthodontics treatment before

Clinical and laboratory data consisting age, race, gender, ABO blood group, result were collected retrospectively from the clinical notes.

The digital images were investigated (Orthopantomogram [OPG]) using Romexis software (Planmeca, Finland) operating with computer (Aspire V3-471G, Acer, TAIWAN) and 14-inch monitor screen.

Blood samples

Blood group was determined using tile method. Blood groups of patient were obtained from medical records, patients' blood donation card and from blood bank.

OPG investigation

Panoramic radiographs taken at the initial examination were used to determine the presence of M3 germs. The existing M3 is further access for their status of impaction. Angulation of the impacted M3 is determined by Winter's classification and the depth and relation of M3 to the adjacent second molar by Pell and Gregory classification.

The angle of the impacted third molar was measured using tools available in the ROMEXIS software (Planmeca, Finland). The mandibular third molar was then classified according to the Winter's classification with reference to the angle formed between the lines intersecting the long axis of second and third molars (Quek *et al.* 2003)^{8,9}.

Classification of the angulation⁸⁻¹⁰:

- Vertical impaction: 10 to -10
- Mesioangular impaction: 11 to 79
- Horizontal impaction: 80 to 100
- Distoangular impaction: -11 to -79

Uncommon angulations such as buccolingual, mesioinverted, distoinverted and distohorizontal angulations were classified as 'other'. Maxillary third molars were recorded as impacted when the lowest portion of the crown of an impacted maxillary third molar was below the occlusal plane of the second molar.

The level of impaction was determined using Pell and Gregory classification. Pell and Gregory classification is another system that widely used to access the degree of difficulty of extracting impacted mandibular third molar. (Garcia *et al.* 2000)¹¹.

The Pell and Gregory classification^{11,12}:

The depth of impaction of the crown of the mandibular third molar was considered in relation to occlusal plane of the adjacent second molar:

- Class A = the occlusal plane of the impacted tooth is at the same level as the occlusal plane of the second molar.
- Class B = the occlusal plane of the impacted tooth is between the occlusal plane and the cervical line of the second molar

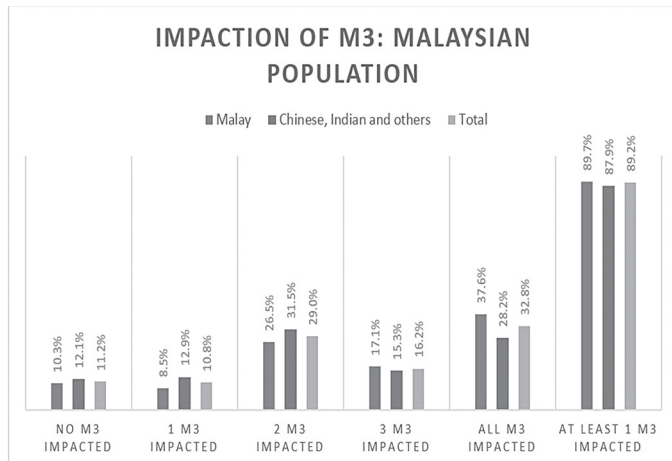


Figure 3. Distribution of subjects with M3 impaction in Malaysian population

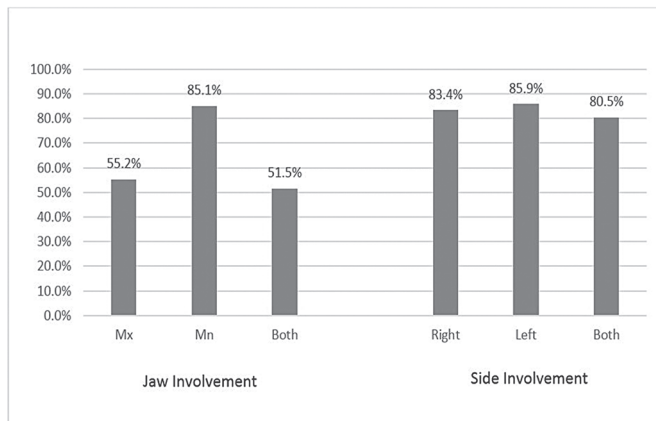


Figure 4. Distribution of M3 impaction of subjects in total population with jaw and side involvement

- Class C = the impacted tooth is below the cervical line of the second molar.

The relation of the tooth to the anterior border of the ramus of mandibular second molar is classified as below:

- Class I = there is sufficient space between the ramus and the distal part of the second molar for the accommodation of mesiodistal diameter of the third molar.
- Class II = the space between the second molar and the ramus of the mandible is less than the mesiodistal diameter of the third molar.
- Class III = all or most of the third molar is in the ramus of the mandible.

Statistical Analysis

Data collected were analysed using IBM SPSS Statistic Version 22 with confidence level set at 5% ($P < 0.05$) to test for significance. The kappa statistics has been used to determine intra- and interexaminer agreements. The M3 number of M3 impaction, pattern of angulation, depth of impaction and relation to the anterior ramus of the mandible were calculated with respect to race, genders, and ABO blood group. Pearson chi-square test was used to determine potential differences in the distribution of M3 impaction.

RESULTS

Status of impaction of third molar tooth germs in orthodontics patients in Klinik Orthodontik Universiti Sains Malaysia:

Table 1. Distribution of subjects with impacted third molars by gender

Total number of impacted third molars	Females (n, %)	Male (n, %)	Total (n, %)	Significant different value, P-value
0	18(10.8)	9(11.0)	27(11.2)	
1	13(7.8)	13(17.3)	26(10.8)	$\chi^2 = 10.806$ (4),
2	43(25.9)	27(36.0)	70(29.0)	$P=0.029$
3	31(18.7)	8(10.7)	39(16.2)	
4	61(36.7)	18(24.0)	79(32.8)	
At least one impacted M3 (n, %)	148(89.2)	66(88.0)	241(100.0)	
*not include zero impaction				

Figure 1 shows the prevalence of total number of third molar impaction in our study population.

Figure 2 reveals that the most commonly impacted M3 was M3 38 (72.6%), followed by M3 48 (71.0%), M3 28 (46.9%) and the least M3 18 (36.5%)

Inter races disparities

Figure 3 shows the distribution of subjects with different number of M3 impaction. The difference between the racial was similar and not statistically significant.

Inter sex disparities

Of 241 patients, there were 75 male and 166 female patients. Table 1 shows distribution of subjects with impacted third molars by gender. Females are 1.75 more likely to have 3 M3 impacted and 1.53 times more likely for all third molar impaction. The association of total number M3 impaction with gender is statistically significant ($P = 0.029$, $P < 0.05$).

Inter side (right and left) jaw (maxilla, mandible and both)

The distribution of impacted M3 in the maxilla and mandible or both and on the right and the left or both were showed in Figure 4 in total population. Although the frequency of impaction is greater in both mandible and left side, however, statistic revealed no significant relationship, indicating that there is no correlation between the frequencies of third molar impaction with gender and ABO blood group (data not shown).

Inter blood group disparities

Figure 5 shows the difference between the ABO blood group in relation to at least 1 M3 impaction. The distribution of at least 1 M3 was the highest in blood group A, followed by blood group O, blood group AB and blood group B, with the percentage of prevalence were 94.1%, 90.0%, 87.5% and 83.1% respectively.

Inter angulation of impaction disparities

Table 2 shows the occurrence of different angulations of M3 impaction and their association with blood group. There is no significant differences detected between the associations of different angulations of impaction of all M3s with ABO blood group.

Inter relation to the anterior border of ramus disparities

Table 3 shows the result of relation to the anterior border of ramus of mandible of M3 38 & M3 48 by blood group and no significant association was found between the relations to anterior border of ramus with blood groups.

Inter depth of impaction disparities

Table 4 shows the result of distribution of depth of impaction of M3 38 & M3 48 by blood group and there was no significant association was found between the depth of impaction and the blood groups.

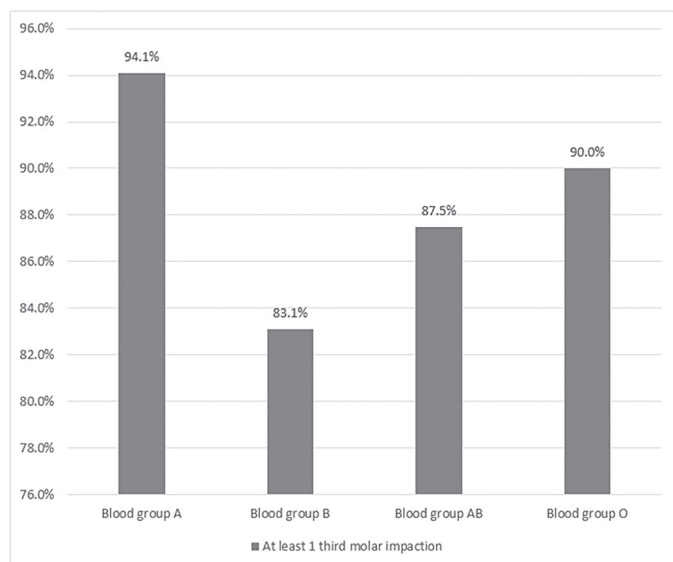


Figure 5. Association of at least 1 M3 impaction with ABO blood group

Table 2. The occurrence of different angulations of impaction of M3 (18, 28, 38 and 48) and its association with blood group

18 and its association with blood group						
Blood Group	Not Impacted	Vertical	Mesioangular	Horizontal	Distoangular	Others
A	54.4%	16.2%	17.6%	0.0%	7.4%	4.4%
B	63.1%	7.7%	12.3%	1.5%	10.8%	4.6%
AB	72.9%	2.1%	8.3%	0.0%	12.5%	4.2%
O	66.7%	15.0%	6.7%	1.7%	10.0%	0.0%
Total	63.5%	10.8%	11.6%	0.8%	10.0%	3.3%
28 and its association with blood group						
Blood Group	Not Impacted	Vertical	Mesioangular	Horizontal	Distoangular	Others
A	44.1%	8.8%	22.1%	1.5%	22.1%	1.5%
B	60.0%	4.6%	13.8%	1.5%	15.4%	4.6%
AB	58.3%	6.3%	16.7%	0.0%	16.7%	2.1%
O	51.7%	16.7%	18.3%	1.7%	10.0%	1.7%
Total	53.1%	9.1%	17.8%	1.2%	16.2%	2.5%
38 and its association with blood group						
Blood Group	Not Impacted	Vertical	Mesioangular	Horizontal	Distoangular	Others
A	26.5%	22.1%	35.3%	7.4%	4.4%	4.4%
B	30.8%	7.7%	33.8%	12.3%	7.7%	7.7%
AB	25.0%	10.4%	41.7%	8.3%	4.2%	10.4%
O	26.7%	15.0%	41.7%	10.0%	3.3%	3.3%
Total	27.4%	14.1%	37.8%	9.5%	5.0%	6.2%
48 and its association with blood group						
Blood Group	Not Impacted	Vertical	Mesioangular	Horizontal	Distoangular	Others
A	30.9%	14.7%	32.4%	8.8%	10.3%	2.9%
B	32.3%	12.3%	38.5%	6.2%	9.2%	1.5%
AB	25.0%	8.3%	43.8%	6.3%	8.3%	8.3%
O	26.7%	18.3%	31.7%	10.0%	5.0%	8.3%
Total	29.0%	13.7%	36.1%	7.9%	8.3%	5.0%

Table 3. Relation to the anterior border of ramus of mandible of M3 38 & M3 48 by blood group.

Blood group	M3 38				M3 48			
	I (n, %)	II (n, %)	III (n, %)	Total (n, %)	I (n, %)	II (n, %)	III (n, %)	Total (n, %)
A	15(29.4)	33(64.7)	3(5.9)	51(100)	14(28.6)	35(71.4)	0(0.0)	49(100)
B	17(37.8)	25(55.6)	3(6.7)	45(100)	17(38.6)	27(61.4)	0(0.0)	44(100)
AB	9(25.7)	23(65.7)	3(8.6)	35(100)	14(38.9)	21(58.3)	1(2.8)	36(100)
O	22(50.0)	20(45.5)	2(4.5)	44(100)	22(50.0)	22(50.0)	0(0.0)	44(100)
Total	63(36)	101(57.7)	11(6.3)	175(100)	67(38.7)	105(60.7)	1(0.6)	173(100)

Table 4. Depth of impaction of M3 38 & M3 48 by blood group.

Blood group	M3 38				M3 48			
	A (n, %)	B (n, %)	C (n, %)	Total (n, %)	A (n, %)	B (n, %)	C (n, %)	Total (n, %)
A	24(47.1)	20(39.2)	7(13.7)	51(100)	22(44.9)	25(51.0)	2(4.1)	49(100)
B	23(51.1)	18(40.0)	4(8.9)	45(100)	20(45.5)	22(50.0)	2(4.5)	45(100)
AB	16(45.7)	15(42.9)	4(11.4)	35(100)	17(47.2)	16(44.4)	3(8.3)	35(100)
O	18(46.3)	25(56.8)	1(2.3)	44(100)	20(45.5)	22(50.0)	2(4.5)	44(100)
Total	81(46.3)	78(44.6)	16(9.1)	175(100)	79(45.7)	85(49.1)	9(5.2)	173(100)

DISCUSSION

Third molars are the most commonly impacted teeth among all the population groups around the globe^{2,3}. Most of the patients in this study were from the second to third decade of life, other studies also showed maximum subjects in the comparable age group^{1-3,8,9,13-15}. This is the first study to evaluate the prevalence of third molar impaction in Malaysia and the association with ABO blood group. A total of 241 panoramic radiographs were analyzed and about two third of patients in present study were female (68.9%). For gender distribution, this study is in accordance with many other studies with female predominance¹⁴. But a few studies show male predominance^{13,16}. Equal gender distribution was also noted in one study²⁴. We found that 88.8% of patients attending the Orthodontik Klinik Universiti Sains Malaysia had at least one impacted M3, indicating how common M3 impaction is in the study population.

The aetiology of high prevalence of M3 impaction has never been investigated in Malaysian population. Future study on the aetiological factors are needed to determine whether this is an emerging problem or due to influences of the population's ethnic background.

The prevalence found from our study was higher than that observed by many other studies¹⁷⁻²¹. Samira *et al*¹⁷, Quek *et al*¹⁸, Hassan *et al*¹⁸, Hattab *et al*¹⁹, and Reddy *et al*²⁰, reported a frequency of 54.3% in Oman population, 68.6% in Singaporean Chinese, 40.5% in Saudi Arabians, 47.4% in Jordanian students, and 27% among Indians population. In the current study, the most common number of M3 impaction was all 4 M3 impacted (32.8%), which is in the agreement with Hattab *et al*¹⁹ but not with Samira *et al*¹⁷ and Quek *et al*¹⁸ who reported 2 M3 was the most common number of impacted third molars per OPG. In contrast, Hassan *et al*¹⁸ reported that the 1 is the most common number of impaction in Saudi Arabians.

Radiological examination of the OPGs revealed that mesioangular impaction was the most common type of angulation according to Winter's classification. This is in accordance with many other stud-

ies^{10,15-18}). However, a few studies showed vertical impaction as the most common type of M3 impaction in their population.²⁰ Horizontal impaction was also recorded as most common type in one study²¹). This could be due to the different method of classifying the angulation used in respective studies. Besides, no significant difference was found between angulations of the impacted M3 with the blood group.

CONCLUSION

This is the first cross-sectional radiographic study investigating the prevalence of third molar impaction association with ABO blood group in Orthodontik population in Malaysia.

- Prevalence of at least one M3 impaction in this orthodontic population is 89.7%, 87.9% and 89.2% in Malay, others and total population.
- Females is found to have higher prevalence of total number of 3 M3 impaction while male is 2.
- Blood group A (94.1%) has highest prevalence of impacted M3, followed by blood group O (90.0%), blood group AB (87.5%) and blood group B (83.1%).
- These results revealed that impaction of M3 do not depends significantly on race, side, jaw involvement and blood group.
- M3 impaction according to Winter's classification and Pell and Gregory's classification are not statistically significant associated with ABO blood group.

A high prevalence is found, with more than $\frac{3}{4}$ of these patients having at least one impacted M3, highlighting the need to increase awareness among dental professionals. We encourage more studies to be conducted in future in other population around the world and compare their results with our findings. Further studies should also be conducted to determine the underlying risk factor of M3 impaction other than ABO blood group.

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