Radiographic Study of the Prevalence and Pattern of Impacted Mandibular Third Molars in a Northern Nigerian Population

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Key words: Impacted teeth, panoramic radiograph, third molar.

ABSTRACT

Background: The incidence of impacted mandibular and maxillary third molars has become a global public health concern. This study reports a radiographic prevalence and pattern of impacted mandibular third molars among a Nigerian population.

Objectives: The aim of this study was to determine the prevalence and pattern of impacted mandibular third molars in a Northern Nigeria population.

Materials and Methods: This retrospective cross-sectional study was conducted at the Oral Diagnostic Sciences Department of the Aminu Kano Teaching Hospital Kano, Kano State, Nigeria. Digital diagnostic images of patients of record on Planmeca Promax® within the sampling frame and acquired during the two years under review, were included in the study. The images were analyzed on Planmeca Romexis 4.3.0 R software to identify relevant study variables. Descriptive statistics was done using SPSS for windows software version 23.0 (IBM, Chicago IL., USA). Also, Pearson's Chi-square (χ^2) statistical test was applied while confidence interval and P-value were set at 95% and ≤0.05, respectively.

Results: A total of 4,932 pantomographs were reviewed and 576 were selected for the study. There were 824 impacted mandibular third molars within the age range of 18-65 years (mean age±SD = 32.67±9.69). 297 (51.6%) were males, and 279 (48.4%) were females. The prevalence of impacted mandibular third molar was 16.71%. Impacted mandibular third molar occurred more frequently in the 26-35 years age range. The most frequent angle of impaction was horizontal, followed by mesioangular, and the least frequent angulation was distoangular.

Conclusion: The prevalence and pattern of impacted third molars among Northern Nigeria population are almost similar to other racial populations with minor variations, and the prevalence decreases with increasing age. A proper radiographic evaluation of the patterns of third molars impaction is, therefore, essential to assist dental surgeons in making decisions with regard to surgical planning and treatment.

INTRODUCTION

Impaction is the failure of teeth to erupt into normal functional occlusion within the projected time of eruption.[1,2] Third molars normally erupt between 18 and 25 years and the pattern of eruption and dental anatomy have significant impact on oral health and quality of life.[3] The third molars are the last

permanent teeth to erupt into the oral cavity and the most frequently impacted.

The etiology of impaction of mandibular third molars is multifactorial and may include lack of space on the arch, displacement of the third molar tooth bud, delayed mineralization, abnormal consistency of overlying bone or soft tissue, reduced transverse dimensions of the mandible, or pathological lesions.[4] Impacted mandibular third molars are often asymptomatic and may be an incidental finding during diagnostic review of panoramic radiographs. Impacted mandibular third molars may also affect the oral health-related quality of life and are, therefore, recommended for extraction to avoid associated complications.[5] These complications may include root caries on the adjacent tooth, unhealthy crowding, pericoronitis, pathological root resorption, bone resorption and cyst formation.[5,6,7]

It has been proposed that the coarse nature of prehistoric human diet, as compared to modern predominantly soft, requires more mechanical activity of the masticatory muscles. This stimulates greater growth of the jawbone, leading to more spaces for physiological third molar eruption.[8] Other theories have proposed contributory factors of impaction, including lack of sufficient eruption force, hereditary factors, lack of mesial movement of the dentition, and malocclusion.[8,9]

Winter's Classification System is used to determine the angle of impaction, being the angle formed between the intersected longitudinal axes of the second and third molars.[10] The angle of impaction can also be measured using the Quek et al.[11] proposed classification system. This is done by calculating the angle of intersection formed between the long axis of second and third molars, using an orthodontic protractor. The relationship of the ramus to the impacted third molar and the level of third molar impaction can also be evaluated using the Pell and Gregory classification system.[12]

The aim of this study was to determine the prevalence and radiographic pattern of impacted mandibular third molar in a Northern Nigeria population.

MATERIALS AND METHODS

This descriptive retrospective cross-sectional study was conducted at the Oral and Maxillofacial Radiology Unit of Oral Diagnostic Sciences Department, Aminu Kano Teaching Hospital Kano, Kano State, Nigeria. It included digital panoramic images of acquired and processed, using Planmecca Promax digital Panoramic machine and Planmecca Romexis software 4.3.0R respectively for patients that visited the clinic from 1st January 2021 to 31st December 2022. Ethical approval was granted by the Committee on Health Research Ethics, Aminu Kano Teaching Hospital, Kano State. Meanwhile, confidentiality and anonymity of the radiographs and patient identifiers were ensured through blockage of patient's biodata written on the radiographs.

Data were extracted from the digital panoramic radiographs of selected adult patients aged 18 to 65 years, with impacted mandibular third molars in one or both quadrant, who visited the Oral and Maxillofacial Radiology Unit of Oral Diagnostic Sciences Department, Aminu Kano Teaching Hospital within the study period. Radiographs with previous history of trauma to the jaws, craniofacial anomalies (for example, Down syndrome), mandibular third molars with incomplete root formation, and panoramic images with fully erupted mandibular third molars were excluded from the study. Also, radiographs of patients with incomplete demographic records of age and panoramic radiographs taken before or after the study period were excluded from the study.

Third molar impaction

A third molar tooth was considered impacted when it could not attain full eruption to a functional occlusion but with complete root formation.

Angulation of impaction

Using Winter's classification,[13] the angulation of impaction of the mandibular third molar impaction was determined as the angle of intersection formed between the longitudinal axes of the second and third molars. This angle was measured with the Planmeca Romexis 4.3.0R software on the central computer attached to the Planmeca Promax machine. The angles measured were categorized based on the these reference angles adapted from Quek's[11] modification of impacted mandibular angle classification: - mesioangular impaction: 11–79; horizontal impaction: 80–100; Vertical impaction: 10 to −10; distoangular impaction: −11 to −79; others: 111 to −80; and

buccolingual impaction: seen when the crown and roots are superimposed, while uncommon impaction angulations such as 'Mesio-inverted', 'Distoinverted' and 'Disto-horizontal' were classified as 'Others'.

[Figures 1, 2 and 3].

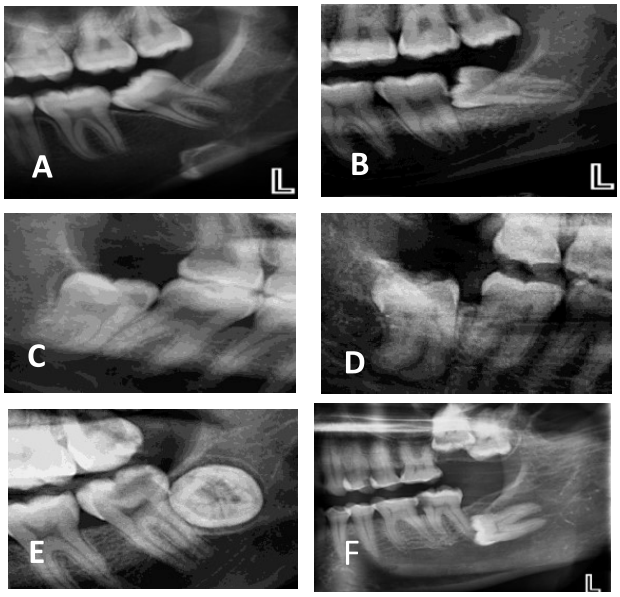

Figure 1: Cropped images of panoramic radiographs demonstrating Winter's Classification System of impaction of mandibular third molar showing: (a) mesioangular impaction, (b) partially bony horizontal impaction, (c) vertical impaction, (d) distoangular impaction, (e) buccolingual impaction, (f) fully intrabony horizontal impaction.

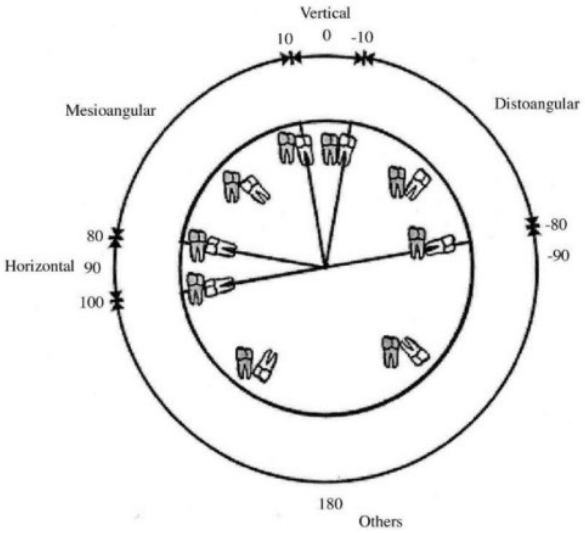

Figure 2: Graphic demonstrating Quek's classification of angulation of impaction, being mesioangular (11 – 79 degrees), horizontal (80 – 100 degrees), distoangular (-11 to -79 degrees), vertical (10 to -10 degrees) , and others (-111 to -80 degrees). [Graphic reproduced with permission from Quek et al[11]]

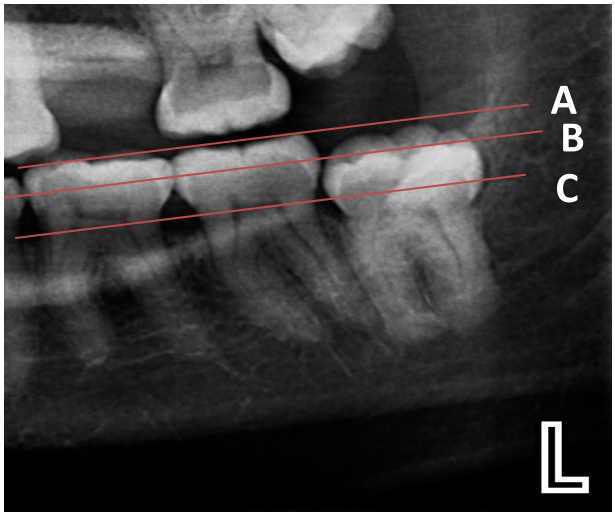

Figure 3: The classification of third molar impaction was adapted from Pell and Gregory Classification and is categorized into: Level A: Not buried in bone; Level B: Partially buried in bone if any part of CEJ was lower than bone level; Level C: Completely buried in bone.

Depth/ Level of impaction

The depth of impaction of the crown of the mandibular third molar was considered in relation to the alveolar bone margin and the cementoenamel junction of the impacted tooth. The classification of the level of third molar impaction was adapted from Pell and Gregory classification[12] and is categorized into: Level A: Not buried in bone; Level B: Partially buried in bone if any part of CEJ was lower than bone level; Level C: Completely buried in bone [Figure 4].

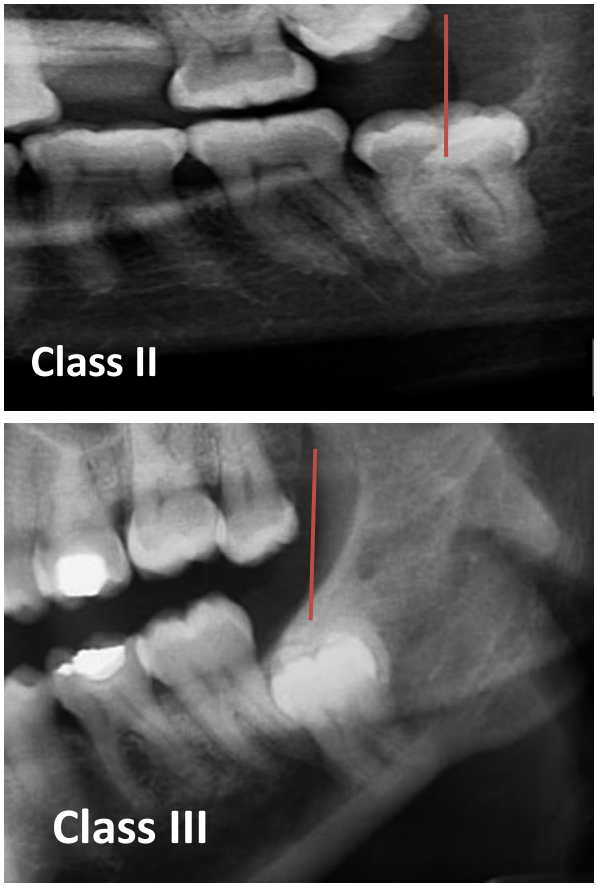

Figure 4: The relationship of the impacted mandibular third molar with the mandibular ramus was categorized into Class I: Anterior to the anterior border of the ramus; Class II: Half of the crown is covered by the anterior border of the ramus; Class III: The crown is fully covered by the anterior border of the ramus.

Mandibular ramus relationship

The relationship of the impacted mandibular third molar with the mandibular ramus was also considered according to the Pell and Gregory classification[12] which assessed the position of the distal surface of the mandibular third molar crown in relation to the anterior border of the ascending ramus of the mandible. These relationships assessed for each impacted mandibular third molar were categorized into Class I: Anterior to the anterior border of the ramus; Class II: Half of the crown is covered by the anterior border of the ramus; Class III: The crown is fully covered by the anterior border of the ramus [Figure 4].

Statistical analysis was performed using SPSS for Windows version 23.0 (IBM, Chicago IL., USA). Descriptive statistics including mean and standard deviations were done and data were summarized as frequency and percentages in tables and appropriate charts. Also, Pearson's Chi-square (χ^2) statistical test was applied while confidence interval and P-value were set at 95% and ≤0.05, respectively.

RESULTS

A total of 4,932 radiographs were reviewed and 576 radiographs selected, with 824 impacted mandibular third molars. The age range of research subjects was 18-65 years (Mean Age±SD = 32.67±9.69). There were 297 (51.6%) radiographs in males, and 279 (48.4%) radiographs in females [Table 1].

Table 1: Distribution of Impacted Mandibular Third Molar according to age and sex.

FACTORS	FREQUENCY	PERCENTAGE	MEAN±SD
AGE			
– 18 – 25	147	25.5	32.67±9.69
– 26 – 35	234	40.6	
– 36 – 45	158	27.4	
– ≥ 46	37	6.4	
SEX			
2 Female	279	48.4	
3 Male	297	51.6	

The prevalence of impacted mandibular third molars was 16.71% [Table 2]. Frequency distribution of impacted mandibular third molars was represented by four different age groups [Table 1]. The frequency of impacted mandibular third molars was highest in the 26–35-year age group (41.26%). Impacted mandibular third molars were least frequent in the age group above 46 years (5.46%). [Table 1]. There was a higher frequency of impacted mandibular third molars in males (51.6%) than in females (48.4%) [Table 1]. There was also a higher frequency of impacted mandibular right third molars in females (50.5%) and impacted mandibular left third molars in males (52.4%) [Table 2].

Table 2: Distribution of 3rd Molar impaction among sexes

FACTORS	FEMALE (%)	MALE (%)	TOTAL (%)
Lower Right Third Molar (LR3M)	203 (50.5)	199 (49.5)	402 (100)
Lower Left Third Molar (LL3M)	201 (47.6)	221 (52.4)	422 (100)

Horizontal impaction was the predominant type of impaction in both females (43.56%) and males (45.24%) [Table 3].

Table 3: Sex distribution of the angulation of impacted mandibular third molars.

TYPE OF IMPACTION	FEMALE (%)	MALE (%)	TOTAL (%)
Mandibular Left Quadrant			
Vertical Impaction	22 (46.8)	25 (53.2)	47 (100)
Horizontal Impaction	84 (44.9)		187 (100)
Mesioangular Impaction	94 (50.8)	91 (49.2)	185 (100)
Distoangular Impaction	1 (33.3)	2 (66.7)	3 (100)
TOTAL (%)	**201** (47.63)	**221**	**422** (100)
Mandibular Right Quadrant			
Vertical Impaction	19 (47.5)	21 (49.5)	40 (100)
Horizontal Impaction	92 (51.4)	87 (48.6)	179 (100)
Mesioangular Impaction	4 (50.0)	4 (50.0)	8 (100)
Distoangular Impaction	88 (50.3)	87 (49.7)	175 (100)
TOTAL (%)	**203** (24.64)	**199**	**402** (100)

The frequency of different angulations of impaction in different age groups is demonstrated in Table 4. On the mandibular left quadrant, Horizontal Impaction was commonest in the age group 26-35-years, (46.8%, P=0.13).

There was a preponderance of horizontally impacted mandibular third molars in the right mandibular quadrant (54.2%, P=0.03). This observation is statistically significant.

Table 4: Age distribution of the angulation of impacted mandibular third molars.

FACTORS	AGE (years) 18 - 25 (%)	AGE (years) 26 - 35 (%)	AGE (years) 36 - 45 (%)	AGE (years) ≥ 46 (%)	Chi Square	P-value (angulation)	P-value (site)
Mandibular Left Quadrant							
Vertical Impaction	12 (10.6)	18 (10.2)	14 (12.5)	3 (15.0)	0.17	0.98	0.02
Horizontal Impaction	50 (44.2)	83 (46.8)	48 (42.9)	6 (30.0)	5.65	0.13	
Mesioangular Impaction	50 (44.2)	75 (42.4)	49 (43.8)	11 (55.0)	0.43	0.93	
Distoangular Impaction	1 (0.9)	1 (0.6)	1 (0.9)	0 (0.0)	0.34	0.95	
TOTAL (%)	113 (100.0)	177(100.0)	112 (100.0)	20(100.0)			
Mandibular Right Quadrant							
Vertical Impaction	7 (6.5)	16 (9.8)	13 (12.1)	4 (16.0)	2.35	0.50	0.89
Horizontal Impaction	58 (54.2)	71 (43.6)	44 (41.1)	6 (24.0)	9.37	0.03	
Mesioangular Impaction	40 (37.4)	74 (45.5)	46 (43.0)	15 (60.0)	2.79	0.42	
Distoangular Impaction	2 (1.9)	2 (1.2)	4 (3.7)	0 (0.0)	2.52	0.47	
TOTAL (%)	107 (100.0)	163(100.0)	107 (100.0)	25(100.0)			

Among the three levels of impaction, according to Pell and Gregory classification, Level B (Partially buried in bone if any part of CEJ was lower than bone level) was observed in 61.7% of impacted molars in the lower left quadrant and 63.4% in the lower right quadrant, and were significantly more prevalent than Level A and Level C on both quadrants of the mandible. The Class II ramus relationship was more common in both quadrants (64.8% and 63.3%) [Table 5].

Table 5: Distribution of the Levels and Classes of impaction of mandibular third molars, using Pell and Gregory Classification

Level/Class of impaction	Mandibular Left Quadrant (%)	Mandibular Right Quadrant (%)
Level/depth of impaction (Pell and Gregory Classification) (%)		
– A	131(31.2)	115(28.5)
– B	259(61.7)	256(63.4)
– C	30(7.1)	33(8.2)
Ramus relationship (Pell and Gregory Classification) (%)		
– Class I	111(26.2)	119(29.9)
– Class II	274(64.8)	252(63.3)
– Class III	38(9.0)	27(6.8)

This present study also found the occurrence of bilateral third molar impaction to be more common than unilateral impaction, with bilateral impaction being predominant in males than in females and also commoner in 26–35-year age group [Table 6].

Table 6: Distribution of unilateral and bilateral impaction

FACTORS	Unilateral (%)	Bilateral (%)	Chi Square	p-Value (by site)
Sex				
– Female	125 (50.4)	154 (47.0)	0.67	0.41
– Male	123 (49.6)	174 (53.0)		
TOTAL (%)	**248 (100.0)**	**328 (100.0)**		
Age				
– 18-25	71 (28.6)	74 (22.6)	8.65	0.03
– 26-35	106 (42.7)	128 (39.0)		
– 36-45	61 (24.6)	97 (29.6)		
– ≥46	10 (4.0)	29 (8.8)		
TOTAL (%)	**248 (100.0)**	**328 (100.0)**		

DISCUSSION

Impaction is a consequence of the inability of teeth to attain full eruption to a physiological and functional occlusion within a specific period. Mandibular third molars usually erupt between ages 18–25 years; they are the last to erupt and have a high propensity for becoming impacted or unerupted.[1] The prevalence of impacted mandibular third molar has been reported to be in the range of 9.5% to 68.6%.[11] In our present study, the prevalence was lower than that reported by Hashemipour et al, 44.3%,[14] Hattab et al, 33%,[15] Eliasson et al, 30.3%,[16] Rajasuo et al, 38%,[17] Montelius, 32%,[18] and Hassan, 40.8%.[19] The prevalence of impacted mandibular third molars in the present study was also observed to be lower than those of Morris et al[20] and Quek et al[11] who reported 65.6% and 68.6% in USA and Singapore, respectively. Whereas the reported prevalence of 16.71% of impacted mandibular third molar in this present study is lower than some studies from other countries, it is still within the reported range of 9.5% to 68.6%[11] but higher

than that reported by Alhadi et al.[21] In the present study, the reported male-to-female ratio of 1:0.96 differs from some of the reports in the literature presenting a higher frequency of impacted mandibular third molar in female than males,[11,14,22-25] while some other studies reported no sex difference in the pattern of third molar impactions.[15,18,26-28] The male-to-female ratio reported in the present study was also not statistically significant.

Horizontal impaction was the most prevalent angulation of impacted mandibular third molars in the present study, representing 44.4%. This observation differs from the reports by Quek et al,[11] Morris and Jerman,[20] Hassan,[19] and Hashemipour et al[14] who reported that mesioangular impaction as the most prevalent type of impaction in the mandibular third molars of Singaporean, American, Arabian, and Iranian populations, respectively. We report five (5) impacted mandibular third molars in our present study that were noted to be completely bony, buccolingually impacted with superimposition of the crown on the roots, and have intricate anatomic relationship to the inferior alveolar nerve. This anatomic location is difficult to access during surgical extraction and may pose a risk of trauma to the vital structures within the inferior alveolar canal. Furthermore, one of the buccolingually impacted mandibular third molar demonstrated ghost image in the contralateral quadrant. Ghost images are formed when the anatomic area of interest is outside the focal trough, and this represents a common phenomenon in panoramic images.

Our study also reports a mesioangularly impacted third molar that was completely bony impacted and in intimate contact with the crown of a mesio-inverted impacted right mandibular distomolar, preventing the eruption of the mandibular right third molar. Distomolars may appear normal or abnormal shaped, they may also be fully erupted or impacted. The morphology of distomolar tooth can be normal with a completely developed crown and single root. Distomolars may also present with abnormal tooth morphology. Therefore, as dental practitioners, we should always be aware of the presence of distomolars on routine radiographic examinations. Meanwhile, Cone Beam Computed tomography (CBCT) enables 3D imaging and provides more precise anatomic localization, association of distomolars to vital structures, and effect on adjacent tooth structures. Our study observed that Level B, (Pell and Gregory classification — Impacted mandibular third molars partially buried in bone and any part of cementoenamel junction is lower than bone level) was the most frequent type of impaction. This observation agrees with similar observations in the literature.[11,19,29] On the other hand, Obiechina et al,[9] Hashemipour et al,[14] and Hugoson and Kugelberg[22] reported Level A (impacted mandibular third molars not buried in bone) as the predominant impaction level. The Pell and Gregory[12] Level of Impaction is, therefore, of surgical significance in the planning of disimpaction of an impacted mandibular third molar. Furthermore, this present study observed that most of the reviewed impacted mandibular third molars had half of their crowns covered with the anterior border of the mandibular ramus, and, thus, were classified as Class II (63.83%), Class I (27.92%), and Class III (7.89%), respectively. This observation was in agreement with report of Obiechina et al,[9] Hashemipour et al,[14] Blondeau et al[30] and Almendros-Marques et al.[31] In agreement with the observation in our present study, impacted mandibular third molars are observed to be generally common amongst young adults under the age of 35 years. [19] This may be the explanation for the common practice of prophylactic third molar extraction among young adult population.

Bilateral impaction occurred in 328 (56.9%) of the 576 radiographs examined, which is lower than that reported by Al-Anqudi et al[32] and Quek et al[11] but higher than reported by Eshghpour et al.[33] These variation in results may be due to racial differences or variation of sampling methods.

CONCLUSION

The prevalence and pattern of impacted third molars among northern Nigeria population are almost similar to other racial populations with minor variations and the prevalence decreases with increasing age. A proper radiographic evaluation of the patterns of mandibular third molar impactions is essential to assist dental surgeons in making decisions with regard to surgical planning and treatment.

LIMITATIONS: This study was conducted over a period of two (2) years. Probably, a longer period would give a broader picture of mandibular third molar impaction and their problems in the population under study.

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Authors' Contributions: Authors 1-6 contributed

to Conceptualization, Data Curation, Formal Analysis, Writing - Review and Editing and Project Administration.

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