

Pattern of Tooth Impaction in a Cameroonian Population; A Retrospective Radiographic Study

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Abstract

Tooth impaction is a frequent disorder encountered by dental practitioners. An impacted tooth is a tooth that is prevented from erupting into position because of malposition, lack of space, or other impediments. The aim of this study was to determine the prevalence and pattern of impacted teeth amongst adults in a Cameroonian population.

This is a retrospective descriptive study using 910 panoramic radiographs of patients with the age group of 21 - 72 years in three radiological centers in the city of Yaoundé.

The prevalence of tooth impaction was 18.8% in the Yaoundé population. Tooth impaction was commonly seen in younger population that is the 21 - 30 years age group. Significant difference was observed between the males 92 (54.1%) and females 78 (45.9%). The third molar was the most commonly impacted teeth 269 (93.2%) and the least commonly impacted was the incisor 1 (0.35%). The mesio-angular impaction 118 (43.9%) was the most common pattern of third molar impaction. The maxillary third molar was more in relationship with the maxillary sinus 9 (56.3%). Among the impacted mandibular third molars, 83 (45.6%) had Class II pattern of impaction.

Interruption of white line was the most significant radiographic risk predictor sign 83 (72.1%) that indicated close proximity of impacted mandibular third molar to the inferior alveolar canal.

The presence of impacted teeth and associated relationships should caution the dental surgeon regarding close proximity to the inferior alveolar canal and thus the need for further radiographic explorations.

Future studies should evaluate the etiology of teeth impaction in Yaoundé.

Keywords: *Impacted Teeth; Panoramic Radiograph; Adults; Yaoundé*

Introduction

Tooth impaction is a pathological condition in which a tooth fails to erupt to the normal functional position within the expected time. This might be due to lack of space, or physical barriers [1,2].

Any permanent tooth can be impacted as several systemic and local factors are responsible for tooth impaction. Local factors identified as causes of tooth impaction are supernumerary teeth, dense overlying bone, prolonged deciduous tooth retention, mal-posed tooth germs, arch-length discrepancies, odontogenic tumors, cleft lip and palate. Less common systemic factors such as cleidocranial dysplasia, down syndrome, febrile diseases and endocrine deficiencies have also been identified [3].

The mandibular last molar has been reported in several studies to be the most commonly impacted tooth followed by the maxillary third molars, the maxillary canines and the mandibular premolars [3,4]. Impaction of the incisors is relatively rare compared to the other teeth and when present the cause is often a retained deciduous tooth or the presence of another abnormality like an odontoma. Multiple impactions are in most instances seen in association with some syndromes such as cleidocranial dysostosis, Gardner's syndrome, Gorlin-Sedano syndrome and Yunis Varon syndrome [4].

According to Elsey and Rock impaction of the third molar occurs in up to 73% of young adults in Europe. Generally, third molars have been found to erupt between the ages of 17 and 21 years. Furthermore, third molar eruption time have been reported to vary with races. For example, mandibular third molars may erupt as early as 14 years of age in Nigerians, and up to the age of 26 years in Europeans. The average age for the eruption of mandibular third molars in males is approximately 3 to 6 months ahead of females. Most authors claim that the incidence of mandibular third molar impaction is higher in females [2].

Impacted teeth are usually painless but when infections of the surrounding tissues occur, severe pain results. Pressure on the inferior alveolar nerve in very deeply positioned lower third molar impactions may be another reason for pain [4].

There are several methods use to evaluate impaction but the orthopantomograph (OPG) is the commonly used in Cameroon.

Generally, OPG are utilized to determine the presence of tooth impaction, its angulations, anatomical obstacles preventing the normal tooth eruption, amount of surrounding bone and its relation to adjacent teeth and vital structures [5].

In Cameroon, there is paucity of literature on the pattern of tooth impaction, and the relationship between impacted tooth with the surrounding structures using radiographs. Therefore the aim of this study was carry out a radiographic evaluation of impacted teeth amongst adults in Yaoundé Cameroon.

Methodology

We conducted a cross sectional descriptive retrospective study in 3 radiological centers in Yaoundé between January 2018 to March 2018. Radiographs between 1st January 2015 to 31st December 2017 were studied.

The three centers (Cathedral medical center, Jordan Medical Services and Hôpital de la Caisse) chosen for this study are the major referral centers for radiographic and medical imagery services in Yaoundé the pollical capital of Cameroon. Since these centers are the only center's with panoramic radiograph facilities Yaoundé, they conduct an average of 30 panoramic radiographic exam per week.

Population and Material

A data capture sheet was used for collecting information from the patient's panoramic radiographs and only radiographs of patients 21 years old and above were selected for the study.

Sampling size

Our sample size was calculated using the data obtained from a similar study conducted by Chu., *et al.* (2003) in the Hong Kong [6]. They came out with a prevalence of 28.5%; we made use of Daniel's formula to get the desired sample size.

$$n = (Z^2p(1-p))/d^2$$

Where n = sample size, Z = level of confidence (1.96), p = prevalence and d = precision (0.05)

$$n = ((1.96)^2 \times 0.285 (1 - 0.285))/0.05^2$$

$$n=276$$

The sample is further increased by 15% to account for recording errors.

Method

Eligible in our study all panoramic radiographs that have been stored digitally for patients who were 21 years old and above. Radiographs with incomplete sociodemographic information, collected in the past 4 years, with artefacts and aberrations were excluded from the study.

All panoramic radiographic digital images of all the centers during the study period were collected in DVD disc and USB keys and all radiographs with impacted teeth were selected and evaluated on a computer. All selected radiographs were checked if sociodemographic information like age and gender of patients with impacted teeth were clearly stated.

The selected radiographs were examined by a radiologist to determine the presence, location, the pattern of impacted teeth and the relationship with surrounding structures.

All teeth that were not erupted for any reason in the oral cavity were evaluated and considered as impacted.

Information collected in the data capture sheet included: The demographic profile of the patients, the frequency of teeth impaction and the pattern of impacted third molars.

There after the radiograph were evaluated generally for different types of tooth impaction.

Evaluation of third molars impaction: The third molars were specifically evaluated was categorized using winter's classification of impacted third molars which is based on the inclination of the third molar to the long axis of the second molar. According to this classification, the orientation is vertical when the long axis of the third molar is parallel to the long axis of the second molar, mesioangular when the long axis of the third molar is in the mid position in relation to the long axis of the second molar, distoangular when the long axis of the third molar is in a distal position in relation to the long axis of the second molar, horizontal when the long axis of the third molar is perpendicular to the long axis of the second molar. Buccal when the third molar is tilted towards the cheek, lingually when the third molar is tilted towards the tongue, inverse when the third molar is in a vertical position with the crown of it rotated in the direction opposite to that of the second molar.

The relation of impacted third molars with the surrounding structures

The relation of the third molar to the maxillary sinus: When 1/3 of the root crosses the sinus floor, 1/2 of the root crosses the sinus floor and the whole root crosses the sinus floor [21].

The relationship between impacted third molar and mandibular ramus: The Pell and Gregory classification (1933) (based on the amount of tooth covered by the anterior border of the ramus was used for this evaluation).

- **Class I:** The third molar is situated anterior to the anterior of the ramus.
- **Class II:** The third molar impaction, half of the crown is covered by the anterior border of the ramus.
- **Class III:** The third molar is totally embedded in the bone of the anterior border of the ascending ramus.

The relationship between impacted third molar and inferior alveolar canal

Described by Prasannasrinivas., et al [27].

Darkening of the root: Loss of root density in a tooth that is impinged upon the canal.

Interruption of the white line: Discontinuity of the superior radio opaque line that constitutes the superior border of the inferior alveolar canal.

Diversification of the canal: A change in the direction of the canal while crossing the mandibular third molar.

- o **Deflection of the root:** An abrupt deviation of root near the canal.
- o **Narrowing of the root:** Narrowing of the tooth roots where the canal crosses.
- o **Narrowing of the canal:** An abrupt decrease in the width of the canal while it crosses the root apices.
- o **Dark and bifid root apex:** A loss of the root density in a tooth that is impinged upon by the canal with bifid apex of the root.

The presence of radiographic risk predictor signs either single or multiple (in combination) on panoramic radiographs were considered as close to inferior alveolar canal radiographically.

Data Analysis

Data was collected using Microsoft Excel 2016 and analyzed with statistical package for social sciences (SPSS) version 20 respectively.

Ethical Considerations

Authorization to carryout research was taken from the Institutional review board of Université des Montagnes. Research authorizations from the administration of the different radiological centers was also considered.

Results

A total of 912 panoramic radiographs were examined made up of 92 (54.1%) males and 78 (45.9%) females (Table 1). A total of 287 impacted teeth were found in 170 radiographs. Tooth impaction was more in males 157 (54.7%) than females 130(45.3%). The gender difference was statically significance of $p = 0.001$ (Table 1).

The prevalence of impacted teeth in our study was 18.8%.

Gender	Number of patients N (%)	Number of impacted teeth N (%)	P-value
F	78 (45.9%)	130 (45.3%)	0.001
M	92 (54.1%)	157 (54.7%)	
Total	170 (100%)	287 (100%)	

Table 1: Distribution of impacted teeth according to patient’s sex.

The mean age of adults with tooth impaction was 34.1 years ± 11.3 s.d. The 21 - 30 years age group (41.2%) (Table 2).

Age Group	Females N (%)	Males N (%)	Total N (%)	P Value
(21 - 30)	35 (44.9%)	35 (38.0%)	70 (41.2%)	0.289
(31 - 40)	23 (29.5%)	31 (33.7%)	54 (31.8%)	
(41 - 50)	15 (19.2%)	13 (14.1%)	28 (16.5%)	
(51 - 72)	5 (6.41%)	13 (14.1%)	18 (10.6%)	

Table 2: Distribution of impacted teeth according to patient’s age.

Frequency of teeth impaction

Tooth impaction was more frequent on the mandibular left third molar 94(32.8%), followed by the mandibular right third molars 88 (30.1%), 45 (15.7%) maxillary right third molar, 42 (14.6%) maxillary left third molar (Table 3).

Tooth number (FDI)	Frequency (N)	Percentage (%)
13	3	1.05%
23	3	1.05%
24	1	0.35%
34	1	0.35%
35	2	0.7%
41	1	0.35%
43	1	0.35%
44	1	0.35%
45	1	0.35%
47	1	0.35%
18	42	14.6%
28	45	15.7%
38	94	32.8%
48	88	30.1%
Supernumerary teeth	3	1.05%
Total	287	100%

Table 3: Frequency of impacted teeth.

FDI: Federation dentaire internationale (Dental numbering system).

Location of impacted teeth

More than a third 100 (34.8%) of the radiographs demonstrated tooth impaction on the mandible, 29 (10.1%) in the maxilla and 41 (14.3%) on both arches. The frequency of impacted teeth with respect to location and gender was not statistically significant (P = 0.057).

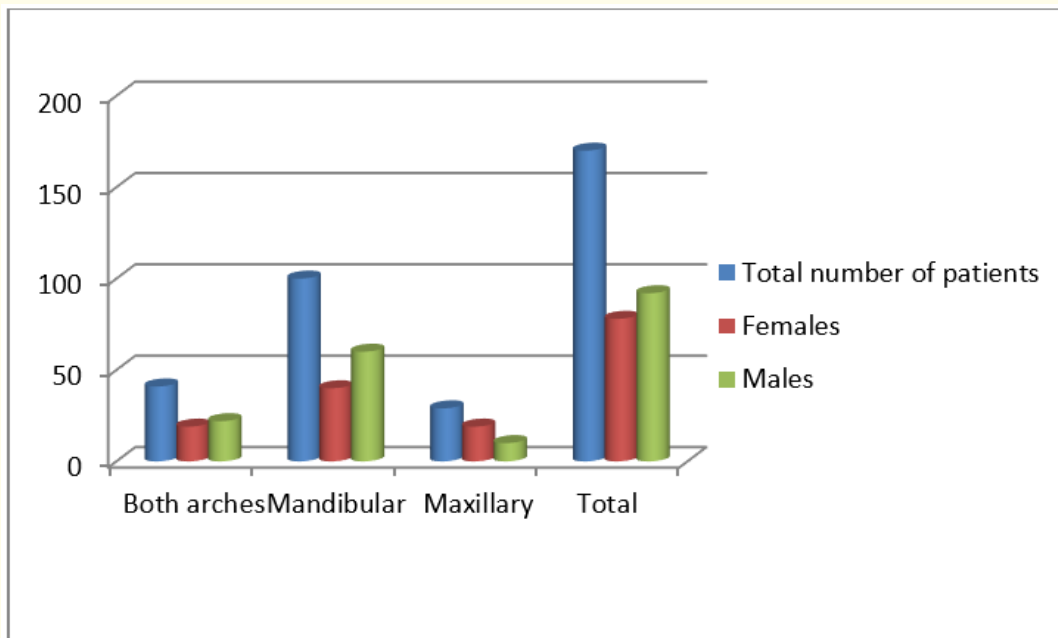


Figure 1: Distribution of teeth impaction in patients according to location

Teeth impaction was more common in the mandible of patients from their radiographs.

Pattern of impacted third molar

The orientation of impacted teeth according to Winter’s classification.

More than a third of the impaction was mesio-angular 118 (43.9%), a quarter 69 (25.6%) vertical, horizontal 51 (19%), disto-angular 16 (5.9%), buccal 8 (3%) and inverse 7 (2.6%) orientations.

According to winters classification the vertical position of the third molars was more prevalent in the maxillary and the mesio-angular in the mandibular.

Winter’s Classification of impaction

Impacted maxillary teeth in relationship with the maxillary sinus.

The maxillary presented 94 impacted teeth of which 16 were in direct contact with the maxillary sinus through the sinus floor. The maxillary third molar are the most represented 9 (56.3%), followed by the maxillary canines 6 (37.4%) and the maxillary premolar 1 (6.3%) which was statistically significant (P = 0.015).

Among the 182 impacted mandibular third molars, 100 were mesioangular impaction (54.9%), 51 horizontal impaction (28%), 19 vertical impaction (10.4%), 7 inverse impaction, 4 buccal impaction (3.8%) and 1 distoangular impaction (0.5%).

Relationship with the inferior Alveolar Canal	Pattern						Total N (%)	P Value
	B	DA	H	I	MA	V		
Darkening of roots	0	0	1	0	2	2	5 (4,5%)	0.236
Interruption of the white line	0	0	20	3	48	12	83 (72,1%)	
Diversion of the canal	0	0	0	0	2	0	2 (1,7%)	
Deflection of the roots	0	0	2	1	12	0	15 (13%)	
Narrowing of the roots	0	0	0	3	0	3	3 (2,6%)	
Narrowing of the canal	0	0	1	2	4	0	7 (6,1%)	
Dark and bifid root apex	0	0	0	0	0	0	0 (0%)	
Total	0	0	24	6	71	14	115 (100%)	

Table 4: Radiographic predictor sign of relationship with inferior alveolar canal.

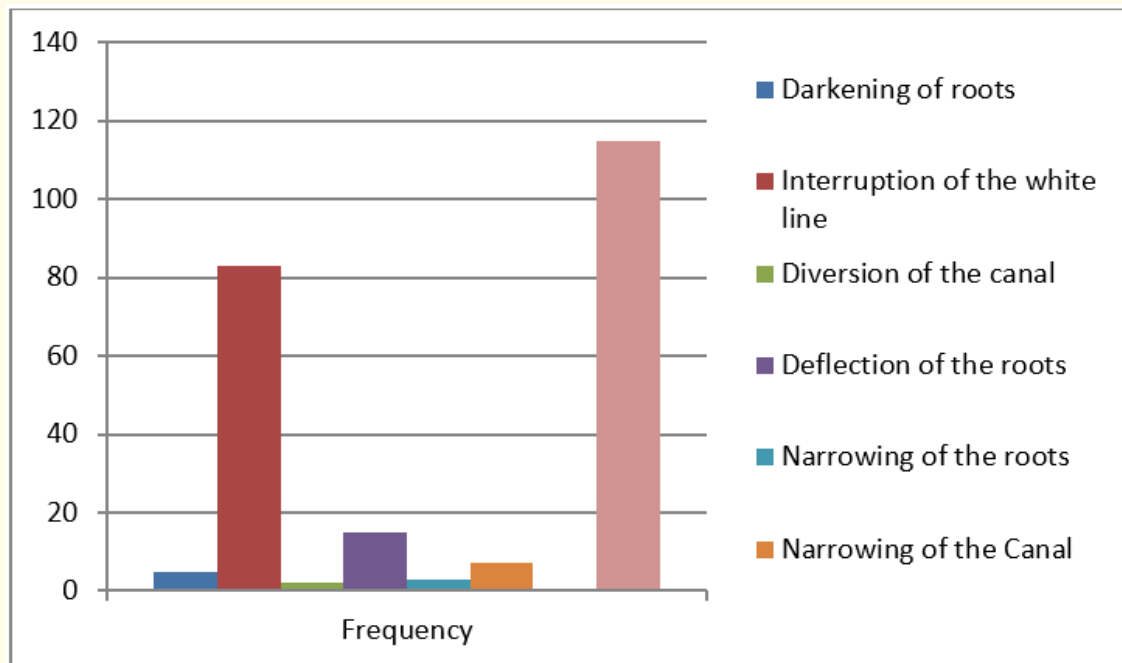


Figure 2: Radiographic predictor signs.

Radiographic risk predictor signs either single or multiple (in combination) were seen in radiographs with 105 (57.7%) impacted teeth and no signs were seen in radiographs with 77 (42.3%) impacted teeth, 95 impacted teeth showed a single sign and 10 showed multiple (in combination) radiographic risk predictor signs.

Analysis of the orientation of impacted teeth compared to radiographic risk predictor signs was not statistically significant (P = 0.236).

Interruption of the white line was noted in 83 (72.1%) and was the most commonly observed radiographic predictor sign, followed by deflection of the roots 15 (13%), narrowing of the canal 7 (6.1%), darkening of the roots 5 (4.5%), narrowing of the roots 3 (2.6%) and diversion of the canal 2 (1.7%). As for dark and bifid root apex, there was no radiographic findings.

Pell and Gregory Classification	Pattern						Total N (%)	P Value
	B	DA	H	I	MA	V		
Class I	0	0	0	13	49	2	64 (35,2%)	< 0.001
Class II	2	1	27	0	42	11	83 (45,6%)	
Class III	2	0	9	7	11	6	35 (19,2%)	
Total	4	1	38	20	102	19	182 (100%)	

Table 5: Relationship of the third molar to the mandibular ramus (classification of Pell and Gregory).

Out of 182 impacted third molars, Class II was the most represented 83 (45.6%) followed by Class I 64 (35.2%) and Class III 35 (19.2%) which was statistically significant (P < 0.001). Mesio angular impaction 103 (56.2%) was predominant in all the classes.

Discussion

The prevalence of impacted teeth in this study was 18.8%, this inferior to that reported by Arabion., *et al.* (2017) reported a prevalence of 44.1% in the central part of Iran [5] also Chu., *et al.* (2003) reported a prevalence of 28.3% in the Hong Kong population [28]. This shows that tooth impaction is very low in black African population.

The 21 - 30 years age group was the most represented (41.2%). The prevalence of impaction reduced as the age increases. This may reflect increased dental awareness in this group of patients and this phenomenon might be probably due to increased extraction of impacted teeth in older patients.

Pattern of teeth impaction: The third molars accounted for the majority 93.2% of all impacted teeth in our study population. This pattern is similar from that reported by Kramer (1970) and Williams, Kruger., *et al* (2001) and Dachi., *et al.* (1961) [29-31]. On the contrast, Obiechina., *et al.* (2001) reported a lower prevalence (72.09%) in the Nigerian population which is similar to our study population [32]. This can be attributed to differences in diet in the 2 different populations. However the prevalence of canine impaction in the current study was not different from other studies reported by Cooke., *et al.* (2006) and Aydin., *et al.* (2004). The impaction of the canine is worthy of attention because the canine has an essential role in occlusal stability and esthetics. The current study showed that maxillary canine impaction was more frequent than mandibular canine impaction. Yavuz., *et al.* (2007) reported a similar pattern of canine impaction was reported in the Turkish population [35].

Very few studies have been done regarding impacted premolars, the low prevalence of premolar impaction could be one of the reasons it is scarcely reported. Results of other studies demonstrated a similar prevalence of premolar impaction as our study [36]. In the current study, the mandibular premolars had a higher propensity (5 times) to be impacted than the lower premolars.

Supernumerary teeth are common in dental practice. According to Backman and wahlin (2001) the prevalence is reported to be between 1 - 3% in adult dentition [37]. The prevalence of supernumerary teeth in this study was 1.05% which is in this interval the supernumerary teeth were observed in the mandibular.

Pattern of third molar impaction

In the current study mesioangular impaction was predominant followed by vertical impaction. This pattern has been reported by other studies carried out both in the African and caucasian population [5,29,38,39].

Relationship between teeth impaction and maxillary sinus

Though few studies have been reported on this relationship our study was able to demonstrate that more than half 9 (56.3%) of maxillary third molar and a third 6 (37.4%) of maxillary canines were located in the sinus. This relationship with the maxillary sinus is important in dental extraction of maxillary molars especially in the creation of oroantral fistula and also in the placement of immediate dental implants.

Relationship between impacted teeth and inferior alveolar nerve canal

Direct trauma of the inferior alveolar nerve during third molar surgery can result to inferior alveolar nerve paraesthesia. According to Libersa., *et al.* (2007), removal of the third molar have been implicated to be one of the major causes of permanent inferior alveolar nerve sensory deficiency than factors like implant and orthognathic surgery [42].

In our study the most reliable radiographic predictor sign was interruption of the white line which signifies the position of the inferior dental nerve. Ghaemina., *et al.* (2009) observed similar finding in their CBCT study, Nakagawa., *et al.* (2007), and Umar., *et al.* (2010) observed similar findings [43-45].

There were also combinations of radiographic risk predictor signs in our study. We can imply that the presence of more than one radiographic predictor sign on the panoramic radiograph indicates a higher probability of close proximity of mandibular third molar to the inferior alveolar canal.

Relationship between teeth impaction and mandibular ramus

Mandibular fracture occurs more frequently than other fracture of the facial skeleton, due to its prominent anatomical position and exposure to external environment according to Subbaiah., *et al* [26]. The mandibular ramus is an area of lowered resistance to fracture according to Lee and Dodson [40]. Mandibular third molars are the most frequently impacted teeth and when there is third molar impaction, it occupies space, there is reduced cross-sectional area of the mandibular angle and thus these results in an area weakness reducing the fracture resistance of the mandible facilitating the occurrence of fracture following minor trauma.

Also the pattern of third molar impaction reported by Subbaiah., *et al.* (2015) is the same as that in our study [26]. In their study mandibular third molar was present in 90% of cases with angle fracture and 73% of the teeth were impacted. Increased incidence of angle fracture was observed in Class II and mesioangular impaction of third molar and in our study Class II and mesioangular impaction were predominant thus are predispose to mandibular angle fracture.

Conclusion

The prevalence of tooth impaction was 18.8% among the Yaoundé population with no sex predilection. Tooth impaction was more common in younger population. The order of impacted tooth types found was similar to previous reports.

Mandibular third molars were the most commonly impacted. Mesioangular orientation was the most common orientation of teeth impaction.

The maxillary third molar was the most common teeth in contact with the maxillary sinus.

Class II was more common among mandibular third molar thus increasing the risk of mandibular angle fracture.

Interruption of the white line was the main radiographic predictor sign. The presence of these radiographic signs should caution the dental surgeon on the proximity of the impacted teeth to the inferior alveolar canal.

Recommendations

- Practitioners
- The presence of impacted teeth and associated relationships should caution the dental surgeon regarding close proximity to the inferior alveolar canal and thus the need for further radiographic explorations.
- Researchers

To our knowledge, the etiology of teeth impaction has never been investigated in the Yaoundé population. Future studies should evaluate the etiology of teeth impaction in Yaoundé.

We recommend studies with higher sample size using recent modalities on the etiology of teeth impaction and associated pathologies.

Authors' Contributions

MCDM, AMA, EA contributed to conception, design, collection of all information required in the drafting of the manuscript. BCM, DJ, SJP were involved in the concept, interpretation of results and reviewing of the manuscript.

Competing Interests

The authors declare that they have no competing interests.

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