Vol: 8 Issue: 1

EDJ

Prevalence and Patterns of Upper and Lower Third Molar Impaction: A Radiographic Retrospective Study Based on a Population in Erbil- Iraq

Layla Muhammad Fatah[(1)] , Ali F. Alzubadee[(1)] , Ribwar F. Khalid[(1)] , Abduljaleel A. Samad[(2)] , Reiad Al-Kamali[(2)]

Abstract

Background and objective: The most impacted teeth in the human oral cavity are the lower third molars. Although they may cause pathology, the unerupted teeth are not pathogenic lesions by themselves. Impaction can manifest at various degrees and in various patterns.

Aim: The aim of this study is to evaluate the prevalence and position of impacted third molars based on the classifications of Pell & Gregory and Winter's classification in a sample of Erbil population, Kurdistan, Iraq.

Methods: This retrospective study examined 880 orthopantomograms (OPG) of patients who were referred to the faculty of dentistry at Tishk International University in Erbil City between September 2022 and October 2023. Age, gender, angulation, and depth of wisdom tooth impactions were among the variables assessed using the Chi-Square test and classified using the methods of Pell & Gregory and Winter's classification.

Results: We found that 65.7% of patients had impaction, and patients with third molar impactions in one jaw had a higher frequency of impaction than patients with impactions in both jaws. The left and right sides of the jaws did not differ significantly from one another. There was a very significant correlation between mandibular and maxillary impaction regarding impaction level and angulation, with mandibular impaction occurring 1.6 times more frequently than maxillary impaction. Additionally, males were more likely than females to exhibit impaction.

Conclusion: The high prevalence of impacted third molars in the studied population, with vertical impaction more predominant in the maxilla and mesioangular impaction more common in the mandible

Keywords: Impacted tooth, Panoramic radiography, Third molar, Wisdom tooth, Erbil Population.

Article Information

Submission Date: 1/8/2024
Revision date: 7/8/2024
Acceptance date: 16/10/2024
Publishing date: Jun 2025

Affiliation Info

[(1)]Faculty of Dentistry, Tishk International University, Kurdistan Region, Iraq.
[(2)]College of Dentistry, Hawler Medical University, Kurdistan Region, Iraq.
Corresponding Author: Layla Muhammad Fatah.
Email: layla.horamy@gmail.com.

DOI: doi.org/10.15218/edj.2025.11

INTRODUCTION

Impacted teeth are defined as those teeth that remain unerupted in the dental arch due to various systemic and local reasons within the expected time.[1] Wisdom teeth become impacted by many factors, lack of space, limited skeletal growth, increased crown size, and late maturation of the third molars.[2] The impacted wisdom teeth are either symptom free that discovered by routine dental examination, or symptomatic which could cause various symptoms and pathologies, such as pericoronitis, pain, swelling, caries, bone loss, root resorption of adjacent teeth, odontogenic cysts and tumors.[3] In human dentition, the third molar has the highest impaction rate of all teeth, and the incidence of this impaction differs among different populations.[4]

Digital panoramic radiography can introduce panoramic view of all the maxillofacial regions. It was used in the diagnosis of impacted third molar variations. The type of impaction assessment can facilitate the treatment plan and the proper method of surgical intervention.[5]

Several methods have been used to classify third molar impaction; the classifications are based on many factors, including the level of impaction, the angulation of the third molars and the relationship to the anterior border of the ramus. The depth or level of maxillary and mandibular third molars impaction can be classified using Pell and Gregory classification system, where the impacted teeth are assessed according to their relationship to the occlusal surface of the adjacent second molar.[2]

According to the literatures different patterns and prevalence of impacted third molars were recorded in different populations, so in this study aimed to determine the status of maxillary and mandibular third molars in Erbil population using orthopantomograms (OPG).

The aim of the Study

Evaluate the prevalence of upper and lower third molar impactions, the angulation of impacted teeth according to the Winter's classification, and the depth of impaction according to the Pell and Gregory classification system, among a sample of people in Erbil city, and whether were any relations between the pattern of impaction and the factors of age and gender.

MATERIALS AND METHOD

A retrospective study has been undertaken in the Faculty of Dentistry at Tishk International University in Erbil City for the duration of September 2022 to October 2023. The total number of patients included in the study was 880 those were referred for OPG radiographs during the study period, of which 578 had impacted third molar. The sample consisted of 304 (52.6%) males and 274 (47.4%) females with an age range of 18 to 40. The age, gender, and general health of the patient were recorded. The OPG was taken for all patients in the Radiology Department, Faculty of Dentistry at Tishk International University in Erbil City using an extra-oral digital Kodak 9000 imaging system with an exposure time of 12.5s, a voltage of 73 kV, and a current of 12 mA (NEWTOM, Italy). The third molar was considered impacted if it was not in functional occlusion and the roots were fully formed.

Inclusion criteria

1. Panoramic radiographs of patients between 18 and 40 years old.
2. Panoramic radiographs of patients with no history of extraction of permanent second and third molar before the study.
3. Panoramic radiographs of patients have no filling in the third.
4. Panoramic radiographs of patients with no systemic disease.

Exclusion criteria

1. Panoramic radiographs of patients who had orthodontic treatment.
2. Radiographs of patients with craniofacial anomaly or syndrome such as Down syndrome; cleidocranial dysostosis.
3. Panoramic radiographs with incomplete records
4. Poor quality panoramic radiographs.

Study parameters

A. Winter's classification[6] was used to categorize the angulation of a third molar tooth that was impacted (Figure 1). Using an orthodontic protractor, the angle created between the third molar's long axis and the second molar's long axis was measured in order to determine the angulation as follow:

- Mesioangular impaction: the impacted tooth is tilted toward the second molar in a mesial

direction (from 11 to 79°).

- Vertical impaction: the long axis of the third molar is parallel to the long axis of the second molar (from 10 to-10°).
- Horizontal impaction: the long axis of the third molar is horizontal (from 80 to 100°).
- Mesioangular impaction: the impacted tooth is tilted toward the second molar in a mesial direction (from 11 to 79°).
- Distoangular impaction: the long axis of the third molar is angled distally/posteriorly away from the second molar (from-11 to-79°).
- Other types of third molar impactions (from 101 to-80°).

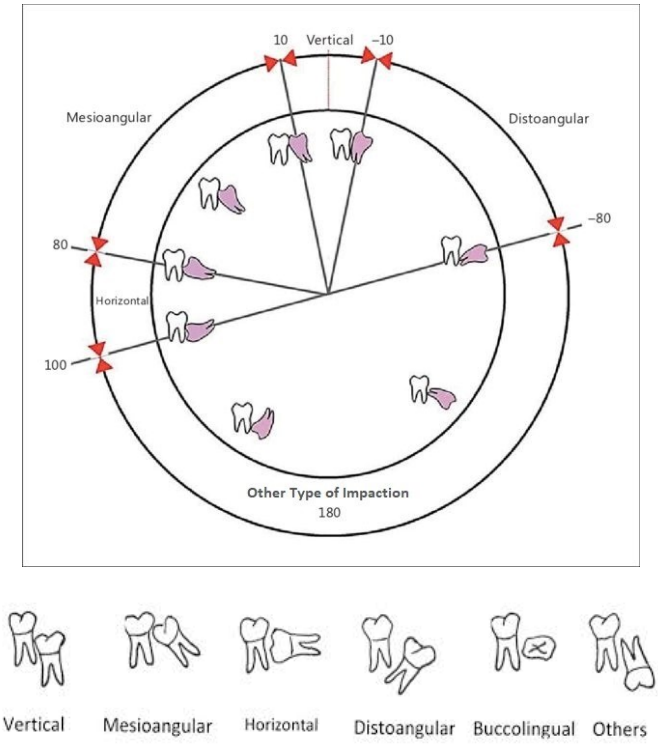

Figure1: Angulation Winter's classification: mesioangular impaction at 11° to 79°; vertical impaction at 10° to –10°; distoangular impaction at –11° to –79°; and horizontal impaction at 80° to 100°, others of impactions (from 101 to-80°).

B. Pell and Gregory Classification: According to Pell & Gregory[7] the positions of third-molar teeth are defined according to the occlusal plane of the second molar tooth and the cervical level of the tooth (Figure 2). The positions were described as follows;

- Position A: the third-molar tooth is at the same level as the occlusal plane of the second molar tooth.
- Position B: the third-molar tooth is between the occlusal plane of the second molar tooth and the cervical region.
- Position C: the third-molar tooth is below the cervical level of the second molar tooth.

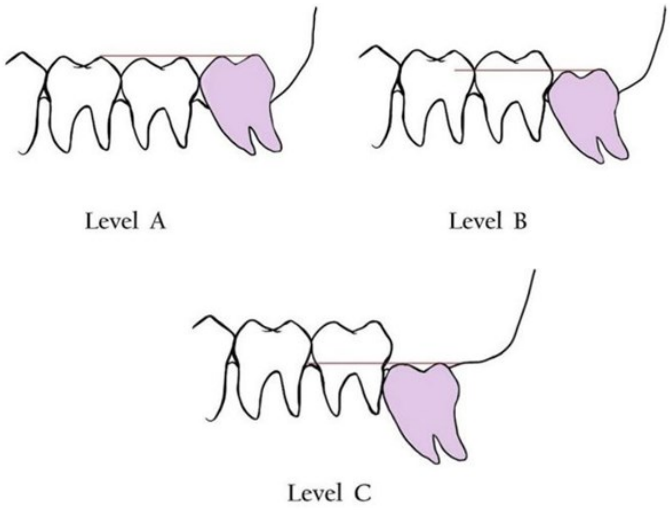

Figure 2: Pell and Gregory classification.

DATA ANALYSES

All data were recorded in Excel sheets during the assessment and were analyzed using descriptive statistics by age groups, gender, arches, angulation, and classes of impaction of third molars. All analyses were performed, a Chi-square test was performed to detect any significance between gender and age with third molar impaction parameters, and the level of significance was set at 0.05 or less (SPSS, version 30, IBM Corp., NY, USA).

RESULTS

This study was undertaken on 880 orthopantomograms. From these records, 578 patients (65.7%) had impacted third molar, 304 (52.6%) were males and 274 (47.4%) were females, The age range was from 18 to 40 years, and wisdom tooth impaction was mostly seen among patients at age 23 (97 patients comprising 16.8%) (Table 1).

DOI: doi.org/10.15218/edj.2025.11

Table 1. Distribution of the sample according to gender.

	Frequency	Percent
Male	304	52.6
Female	274	47.4
Total	578	100.0

From the total number of the sample 202 (34.9) patients showed at least one impacted third molar. The number of patients with two, three, and four impacted third molars was equal to 208 (36%), 102 (17.6%), and 66 (11.4 %) respectively. Details of the impacted tooth number revealed that the means of the four groups are not significantly different with (P-value =0.068) (Table 2).

Table 2: Sample distribution based on gender and the number of impacted third molars

	Gender		Total	
Number of impacted teeth	**Male**	**Female**		**Percentage**
1	105	97	202	35.0%
2	115	93	208	36.o%
3	47	55	102	17.6%
4	37	29	66	11.4%
Total	304	274	578	100.0%

The number of patients with impacted wisdom teeth both in the mandible was 458, 236 males and 222 females, while regarding the maxilla, there were 120 patients with impacted wisdom teeth, 68 males and 52 females, respectively (Table 3).

Table3: Sample distribution according to gender-related impacted third molars in the mandible and maxilla.

			Gender		Total	P-Value
			Male	**Female**		
Site	Maxilla	Count	68	52	120	0.316 Non-Significant
		%	56.7%	43.3%	100.0%	
	Mandible	Count	236	222	458	
		%	51.5%	48.5%	100.0%	
Total		Count	304	274	578	
		%	52.6%	47.4%	100.0%	

Regarding presence of impacted third molars in one jaw or both of upper and lower jaws; (Table 4) illustrates that 218 (37.7%) patients had impacted teeth in their mandibular and maxillary jaws, and 360 (62.3%) patients had impacted teeth in only one jaw.

Table 4: Distribution of the impacted third molars based on the jaws that are affected.

	Frequency	**Percent**
One jaw	360	62.3
Both jaws	218	37.7
Total	578	100.0

Of the 1233 wisdom teeth that were impacted, 475 (47%) were in the maxilla, split between the right and left sides by 228 (36.2%) and 247 (48%); 758 (61.5%) were in the mandible, split between the left and right sides by 357 (59.1%) and 401 (63.8%). The mandibular impaction was 1.6 times greater than the maxillary impaction, indicating no significant link between the side of the jaw and the third molar impaction (Table 5).

Table 5: Distribution of the impacted third molars in the maxilla and the mandible according to jaw sides.

			Mandible	**Maxilla**	**Total**	**P-Value**
Jaw side	Right	Count	401	228	629	0.094 Non-Significant
		%	63.8%	36.2%	100.0%	
	Left	Count	357	247	604	
		%	59.1%	40.9%	100.0%	
Total		Count	758	475	1233	
		%	61.5%	38.5%	100.0%	

According to the Pell and Gregory classification, level B impaction was the highest in the mandible, and level C was the most common in the maxilla. There was a significantly substantial correlation between the jaw and the impaction level (Table 6).

DOI: doi.org/10.15218/edj.2025.11

Table 6: Impaction level according to Pell and Gregory Classification.

Impaction level		Mandible	Maxilla	Total	P-Value	Degree of Significancy
A	Count	202	17	219	0.000	Highly Significant
	%	92.2%	7.8%	100.0%		
B	Count	395	125	520		
	%	76.0%	24.0%	100.0%		
C	Count	161	333	494		
	%	32.6%	67.4%	100.0%		
Total		758	475	1233		
%		61.5%	38.5%	100.0%		
Impaction level		**Mandible**	**Maxilla**	**Total**	**P-Value**	**Degree of Significancy**
A	Count	202	17	219	0.000	Highly Significant
	%	92.2%	7.8%	100.0%		
B	Count	395	125	520		
	%	76.0%	24.0%	100.0%		
C	Count	161	333	494		
	%	32.6%	67.4%	100.0%		
Total		758	475	1233		
%		61.5%	38.5%	100.0%		

Level A: the occlusal plane of the impacted tooth is at the same level as the occlusal plane of the second molar (the highest portion of the impacted third molar is on a level with or above the occlusal plane); level B: the occlusal plane of the impacted tooth is between the occlusal plane and the cervical .

The distribution of impacted third molar by angulation was displayed in (Table 7). The impaction in the maxilla were distributed as follows: vertical (19.0%), distoangular (13.9%), mesioangular (4.7%), horizontal (0.6%), buccoangular (0.3%), followed by transverse (0.1%), and there was no inverted impaction in this sample. The impactions in the mandible were distributed as follows: mesioangular (29.4%), horizontal (17.1%), vertical (12.6 %), distoangular (1.6%), followed by inverted (0.2%), and there was no transverse impaction in the mandible. The statistical analysis revealed that the mandible and maxilla differed in a very significant way.

Table 7: Angulations of impacted lower and upper wisdom teeth.

Angulation	No.&% of impaction	Mandible	Maxilla	Total	P-Value
Bucco-angular	Count& %	6(0.5%)	3(0.3%)	9 (1.8)	0.000 Highly Significant
Horizontal	Count& %	212(17.1%)	7(0.6%)	219(17.7)	
Mesio-angular	Count& %	363(29.4%)	58(4.7%)	421(34.1%)	
Vertical	Count& %	155(12.6 %)	234(19.0%)	389(31.6%)	
Disto-angular	Count& %	20(1.6%)	172(13.9)	192(15.5%)	
Inverted	Count& %	2(0.2%)	0(00.0%)	2(0.2%)	
Transvers	Count& %	0(0.0%)	1(0.1%)	(0.1%)	
Total	Count& %	758(61.5%)	475(38.5%)	1233(100.0)	

DISCUSSION

The extraction of the third molar, which is also a symptom that a patient needs to see an oral and maxillofacial surgeon, is one of the most frequent procedures performed by oral surgeons. It is said that third molars differ from other teeth in the oral cavity. They are the last in the eruption sequence and have the highest chance of developing abnormalities.

1. The prevalence of impaction

The prevalence revealed in this study (65.7%) is higher than that of Lukman (50.17%) in Erbil population[8] Ali's study (40.5%) in the Saudi population[9] and; Yıldırım and Büyükgöz (23%),[10] but lower than that seen in a Singapore study by Quek et al. (68.6%);[11] may be due to different jaw sizes, races and early mineralization with delay eruption.

2. Impacted teeth with gender and age Groups

In this study, 578 patients had at least one impacted wisdom ,304 (52.6%) were male and 274 (47.4%) were female, the age range was from 18 to 40 years, wisdom tooth impaction was mostly seen among patients at age 23 (16.8% ,97 patients), while in Khurshid A. et al ([12]) study, the age range was 24-33 years old, out of all the included impacted cases, 63 (49.7%) were female and ,165 (50.3%) male. On the other hand, Mahmoud Al-Dajani et al ([13]) study sample included 2550 patients with a mean age of 35.8 years old, 1651 males (64.8%) and 899 females (35.2%), But, Ahmed Ali et al[14] study in the Dohuk population, Iraq found that impaction was more frequent in females (18.8%) than in males (10.4%) in 502 patients. Some authors have explained this discrepancy by pointing out that females' jaws stop growing at the moment when mandibular third molars are just starting to erupt, which often means there isn't enough room for them. Male jaw growth continues past the point at which the third molar erupts, allowing for greater room and fewer impactions.

3- Impacted third-molar teeth in both jaws

In this study mandibular impaction represent (60.9%) of all cases while the prevalence of impaction in maxilla (39.1%), this is in agreement with Lukman study,[8] which found among 1150 cases of the impaction, the mandibular impaction was (59.04%) while (39.42%) cases was observed in the maxilla. In Labeed et al[15] study, 428 (38.9%) were in the maxilla and 672 (61.09%) were in the mandible. Also, in Salha et al[16] study, impacted third molars were more likely to occur in the mandible (57.3%) than in the maxilla (42.7%). Many biological variables, including inadequate retromolar distance, condyle growth direction, larger mandibular third molar size, and bone density, have been linked to mandibular third molar impaction.

4-The number of impacted third molars

This study demonstrated that the prevalence of 2 impacted molars in single patient was the highest

DOI: doi.org/10.15218/edj.2025.11

(36 %).while least frequent was (11.4 %) of cases with 4 impacted teeth in single patient, while Labeed et al.[15] study demonstrates the highest percent for 4 teeth impaction (36.98%) and the lowest for 3 teeth impaction (13.38%), and according to Ramizu et al.[17] results, one impacted third molar showed the highest (51.49%) frequency, and three impacted third molar teeth were the least frequent (11.06%). Idris et al. study[18] found that the distribution was: 1 impaction in (41.6%); 2 impactions in (30.9%); 3 impactions in (14.4%); and 4 impactions in (13.1%) patients. Studies have revealed a notable variation in the frequency of impaction cases among various populations, which may be related to dental arch atrophy brought on by industrialization and food processing.

5-The angulation of impacted third molars

This study shows that vertical angulation was the most frequent angulation seen in the maxilla, and mesio-angular was most common in the mandible. In contrast to Al-Dajani et al.[13] study, vertical impaction was the most common pattern in both mandible (40.7%) and maxilla (45.2%), while transfer angulation was the least observed in both jaws. Salha et al.[16] study showed that in the maxillary arch, distoangular impaction was more prevalent (40.4%), while in the lower jaw, most of the impacted third molars (41.4%) were in mesial inclination. Mesiangular orientation of impacted teeth was the most frequent finding in Khurshid A.et al.[12] study, and Katayon and Omed[19] study. It has been suggested that mesioangular impaction of the wisdom teeth is caused by the difference in the growth of the wisdom tooth's mesial and distal roots, which is caused by the mesial root's inadequate growth. In another study done by Samad[20] at Oral and Maxillofacial Surgery Department, College of Dentistry, Hawler Medical University, Erbil, Iraq; out of 116 lower wisdom impacted teeth 51 cases (44%) were with Mesioangular type of impaction.

6-The level of impaction

This study shows that in the maxilla the most common type of depth level pattern is the C depth pattern and the least type of depth pattern is A. While in the mandible right and left sides show that most depth pattern type is B depth level pattern and least one is C, while in Yilmaz S et al. study,[21] level B impaction was the most common in the maxilla (39%), and level C impaction was the most common in the mandible (61%) . in agreement with this study; Al-Madani et al.[16] showed that level C impaction of third-molar teeth had a higher tendency to occur in the maxilla (67.6%), while level B-impacted third molars were the most prominent in the mandible (38.5%). The ethnic and genetic divergences may be the cause of all the discrepancies observed between this inquiry and previous ones.

CONCLUSION:

In conclusion, this radiographic retrospective study highlights a significant prevalence of third molar impactions among the population of Erbil, Iraq. The findings reveal distinct patterns of impaction, with mandibular impactions occurring more frequently than maxillary ones. Vertical impaction was most common in the maxilla, while mesioangular impaction predominated in the mandible. The study will give emphasis to the challenge for early identification and classification of mandibular third molar impactions in the aspect of clinical decision-making for improving patient outcomes. Further studies are required to investigate the underlying causes of these modalities in various populations.

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