



## Research Article

## Comparison Between Impacted Maxillary and Mandibular Canines in an Iraqi Population: Prevalence and Classification

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## Abstract

**Background:** Concerning the importance of impacted canines for aesthetics and function to improve patients' health, it is crucial to provide the oral surgeon and orthodontist with a complete analysis of their location, angulation, and relation with adjacent teeth. **Objective:** To determine and compare the frequencies of different types of impacted maxillary and mandibular canines under the current classification systems in an Iraqi population sample. **Methods:** This study retrospectively examined the cone beam computed tomography scans of 1000 Iraqi patients aged 12–40 years (380 males and 620 females) who had attended the Oral and Maxillofacial Radiology Department at Ghazi Al-Hariri and Al-Sadder City Hospitals. **Results:** Of the 1000 patients, 49 had impacted maxillary canines (4.9%), of which 18(36.7%) were male and 31(63.3%) were female. Bilateral impaction was more common than unilateral impaction (61.2% vs. 19.0%). Type II was the most common impaction type. In addition, 20 patients had impacted mandibular canines (2%), of which 8(40.0%) were male and 12(60.0%) were female. Bilateral impaction was less common than unilateral impaction (25.0% vs. 75.0%). Type III was the most common impaction. **Conclusions:** Impaction was more common for maxillary canines (4.9%) than for mandibular canines (2.0%). Type II impaction was the most common for maxillary canines, followed by Types I, IV, and VII. In contrast, Type III impaction was the most common for mandibular canines, followed by Type V.

**Keywords:** CBCT, Impacted canine, Prevalence classification.

### مقارنة بين الأنياب المظمورة في الفك العلوي والسفلي في عينة سكانية عراقية: الانتشار والتصنيف

#### الخلاصة

**الخلفية:** فيما يتعلق بأهمية الأنياب المظمورة من الناحية الجمالية والوظيفية لتحسين صحة المرضى، فمن المهم تزويد جراح الفم وأخصائيي تقويم الأسنان بتحليل كامل لموقعها وزاويتها وعلاقتها بالأسنان المجاورة. **الهدف:** تحديد ومقارنة ترددات أنواع مختلفة من الأنياب المظمورة في الفك العلوي والسفلي في ظل أنظمة التصنيف الحالية في عينة سكانية عراقية. **الطرائق:** فحصت هذه الدراسة بأثر رجعي عمليات مسح التصوير المقطعي المحوسب ذي الحزمة المخروطية لـ 1000 مريض عراقي تتراوح أعمارهم بين 12 و 40 عامًا (380 ذكرًا و 620 أنثى) الذين حضروا إلى قسم الأشعة الفموية والوجهية والفكين في مستشفى غازي الحريري ومدينة الصدر. **النتائج:** من بين 1000 مريض، كان لدى 49 مريضًا أنياب علوية مظمورة (4.9%)، منهم 18 (36.7%) من الذكور و 31 (63.3%) من الإناث. كان الانسداد الثنائي أكثر شيوعًا من الانسداد أحادي الجانب (61.2% مقابل 19.0%). كان النوع الثاني هو النوع الأكثر شيوعًا للانسداد. بالإضافة إلى ذلك، كان لدى 20 مريضًا انسداد في الأنياب السفلية (2%)، منهم 8 (40.0%) من الذكور و 12 (60.0%) من الإناث. كان الانسداد الثنائي أقل شيوعًا من الانسداد أحادي الجانب (25.0% مقابل 75.0%). كان النوع الثالث هو النوع الأكثر شيوعًا. **الاستنتاجات:** كان الانسداد أكثر شيوعًا في الأنياب العلوية (4.9%) مقارنة بالأنياب السفلية (2.0%). كان الانسداد من النوع الثاني هو الأكثر شيوعًا في الأنياب العلوية، يليه النوع الأول والرابع والسابع. في المقابل، كان الانسداد من النوع الثالث هو الأكثر شيوعًا في الأنياب السفلية، يليه النوع الخامس.

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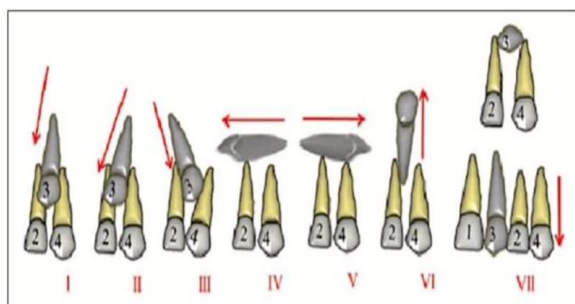


## INTRODUCTION

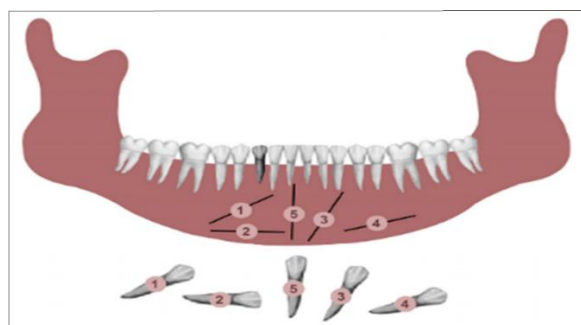
Teeth that remain completely or incompletely embedded in the alveolar bone or mucosa of the jawbone for more than two years beyond the physiological eruption time are defined as impacted [1]. The lower third molars are the most impacted

teeth, followed by maxillary canines [2]. Multiple factors can cause the higher prevalence of impacted canines. The maxillary canine has a longer root and eruption path, developing deep in the jaw. Furthermore, genetic factors play an important role in maxillary canine impactions [3]. Many factors can affect tooth eruption, such as lack of space, trauma,

and genetic factors [4-9]. Notably, maxillary canines are impacted 20 times more often than mandibular canines [10]. For maxillary canines, bilateral impaction is common, while unilateral ectopic impaction is uncommon [11]. Preoperative assessment of impacted teeth regarding their position, depth, orientation, and relation to the adjacent teeth is vital. All these variables cannot be determined without radiographic assessment. Therefore, radiographic tools should be used in the assessment of impacted canines. Cone beam computed tomography (CBCT) is a new imaging modality in dentistry for accurately evaluating impacted canines. It has multiple applications in dentistry [12-14] and orthodontics [15-17]. This study used the Yamamoto classification system [18] to assess impacted maxillary canines and the Mupparapu classification system [19] to assess impacted mandibular canines (Figures 1 and 2). It aimed to establish and compare the frequencies of different types of impacted maxillary and mandibular canines under these classification systems in an Iraqi population sample.



**Figure 1:** The seven subtypes of impacted maxillary canine [18].



**Figure 2:** The five subtypes of impacted mandibular canine [19].

## METHODS

### Study design and participants

This study retrospectively collected CBCT scans for 1000 Iraqi patients aged 12–40 years (380 males and 620 females) who had attended the Oral and Maxillofacial Radiology Department at Ghazi Al-Hariri and Al-Sadder City Hospitals between March 2020 and January 2024. Two CBCT machines were utilized to acquire the data used in this study: a KaVo OP 3D (tube voltage = 90 kVp, tube current = 16 mA, exposure time = 11 s, field of view [FOV] size =  $8 \times 15$ , voxel size = 0.3 mm, software = OnDemand3D) and a Carestream Dental CS 9500 (tube voltage = 90

kVp, tube current = 15 mA, exposure time = 15 s, FOV size =  $12 \times 10$ , voxel size = 0.3 mm, software = Carestream).

### Exclusion criteria

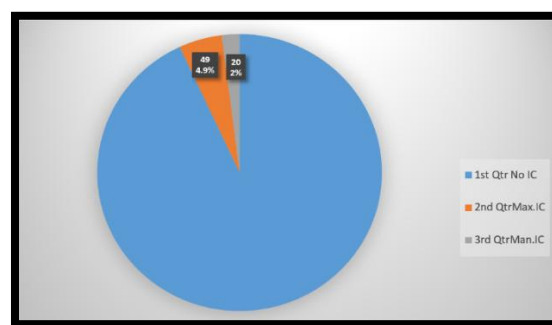
Impacted canine associated with cleft palate. Impacted canine associated with pathological lesion or trauma.

### Analysis procedure

Firstly, the CBCT scans were reviewed to identify any impacted canines that had failed to erupt into the oral cavity. All impacted canines were first reviewed in the 3D view and then diagnosed using a reconstructed panoramic view and matched to the seven subtypes of impacted maxillary canine [18] under a classification system based on the long axis angles and occlusal plane and five subtypes of impacted mandibular canine [19]. The data were analyzed regarding the classification system, gender, and whether the impaction was unilateral or bilateral. This study was conducted according to the Declaration of Helsinki and approved by the Ethics Committee of the College of Dentistry at the University of Baghdad, Iraq (approval number: 913724).

## RESULTS

Of the 1000 patients whose CBCT scans were reviewed, 49 had impacted maxillary canines (4.9%; Figure 3), of whom 18 (36.7%) were male and 31 (63.3%) were female (Table 1).



**Figure 3:** The percentages of impacted maxillary and mandibular canines.

**Table 1:** The prevalence of impacted canines by gender.

Gender	Impacted maxillary canine n(%)	Impacted mandibular canine n(%)
Male	18(36.7)	8(40)
Female	31(63.3)	12(60)

Bilateral impaction (61.2%) was more common than unilateral impaction (19.0%) (Table 2).

**Table 2:** The prevalence of impacted canines by affected side

Impacted maxillary canine n(%)		Impacted mandibular canine n(%)	
Bilateral	Unilateral	Bilateral	Unilateral
30(61.2)	19(38.8)	5(25)	15(75)

Type II impaction was the most common (37.9%). In addition, 20 patients had impacted mandibular canines (2.0%), of whom 8 (40.0%) were male and 12 (60.0%) were female (Table 3). Bilateral impaction (25.0%)

was less common than unilateral impaction (75.0%). Type III impaction was the most common (72.0%) (Table 4).

**Table 3:** The prevalence of impacted maxillary canines by classification type

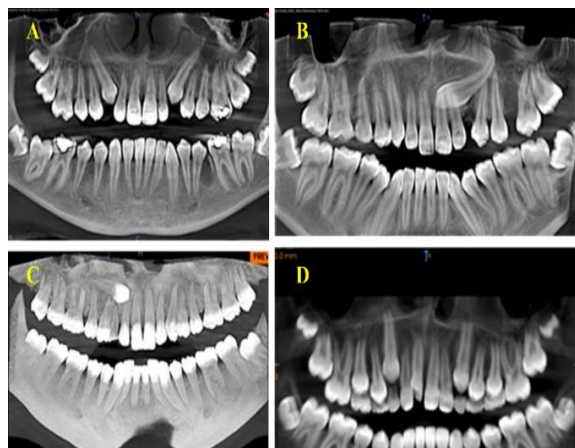
Gender	Impacted maxillary canine type n(%)							Total
	I	II	III	IV	V	VI	VII	
Male	7(8.9)	16(20.2)	1(1.2)	2(2.5)	0(0.0)	0(0.0)	1(1.2)	27(34.1)
Female	8(10.1)	30(37.9)	0(0.0)	8(10.1)	1(1.2)	0(0.0)	5(6.3)	52(65.8)

**Table 4:** The prevalence of impacted mandibular canines by classification type

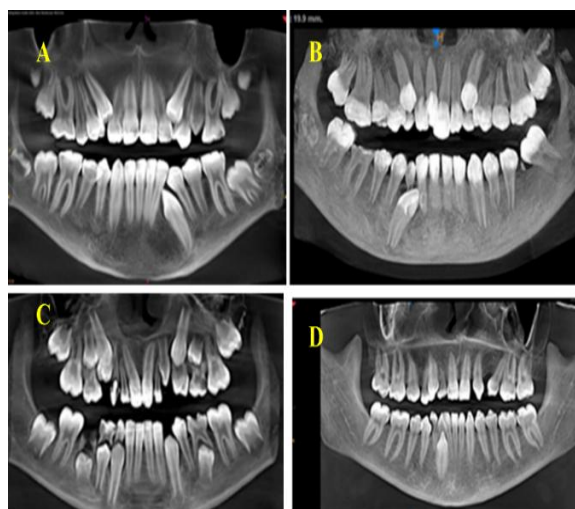
Gender	Impacted mandibular canine type n(%)					Total
	I	II	III	IV	V	
Male	0(0.0)	0(0.0)	6(24)	0(0.0)	3(12)	9(36)
Female	0(0.0)	0(0.0)	12(48)	0(0.0)	4(16)	16(64)
Total	0(0.0)	0(0.0)	18(72)	0(0.0)	7(28)	25(100)

## DISCUSSION

Our study found that the prevalence of impacted maxillary canines was 4.9% among 1000 Iraqi patients whose CBCT scans were reviewed (Figures 4 and 5), like other studies in Türkiye (5.1%) [9] and Hungary (5.4%) [20].



**Figure 4:** CBCT panoramic view: (A) Type II, (B) Type IV, (C) Type V, and (D) Type I impacted maxillary canines.



**Figure 5:** CBCT panoramic view: (A, B) Type III, (C, D) Type V impacted mandibular canines.

The long eruption path is one factor affecting the impaction of maxillary canines [21]. Our study also found that the prevalence of impacted mandibular canines was 2.0% among the 1000 Iraqi patients, higher than in other studies on various populations that reported prevalences of impacted mandibular canines ranging from 0.07% to 1.36% [22-27]. While the prevalence found in our study is higher than in these studies, it is consistent with other studies that reported prevalences for impacted mandibular canines of 1.7% [28] and 1.36% [29]. Among the 49 patients with impacted maxillary canines identified in our study, 18 were male and 31 were female. Similarly, among the 20 patients with impacted mandibular canines identified in our study, 8 were male and 12 were female. Therefore, impacted maxillary canines are more common in females than in males, consistent with previous studies [27,29]. This difference may be related to the smaller skull size in females. Our study found that unilateral impaction (38.8%) was less common than bilateral impactions (61.2%) for impacted maxillary canines, contrasting with other studies [30-32]. However, our study found that unilateral impaction was more common than bilateral impaction for impacted mandibular impacted canines, consistent with these studies. This discrepancy may be due to differences in sample sizes or populations. In addition, our study found that Type II impaction was the most common for maxillary canines, followed by Types I, IV, and VII. While a previous study [30] also found Type II to be the most common, the order of the other types differed: Types VI, I, and VII. Different studies have reported different findings. In the study by Mupparapu [19], Type I impaction was the most common for mandibular canines, followed by Types II, IV, III, and V. In our study, Type III impaction was the most common for mandibular canines, followed by Type V; the other types were not observed in our study. To our knowledge, no similar studies to ours exist, and the differences among previous studies might be related to the small number of transmigrated mandibular canines found. Regarding the importance of impacted canines for aesthetics and function, it is crucial to provide the oral surgeon and orthodontist



with a complete analysis of their location and relation with adjacent teeth.

### Study limitations

One of the important limitations in this study was the difficulty of data collection, it takes a long time because the data was obtained from different centers utilizing different devices. The second limitation was that the study restricted to mid field of view (FOV) only which led to neglecting a large number of small view scans.

### Conclusions

Our study found a prevalence of 4.9% for impacted maxillary canines and 2.0% for impacted mandibular canines. Females were more affected by impacted maxillary and mandibular canines than males. Bilateral impaction was more common than unilateral impaction for maxillary canines, while the opposite was true for mandibular canines. Type II impaction was the most common for maxillary canines, followed by Types I, IV, and VII. Type III impaction was the most common for mandibular canines, followed by Type V, while Types I, II, and IV were not observed in our Iraqi population sample.

### Conflict of interests

No conflict of interest was declared by the authors.

### Funding source

The authors did not receive any source of funds.

### Data sharing statement

Supplementary data can be shared with the corresponding author upon reasonable request.

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