

Impacted Permanent Mandibular Canines: A Radiographic Study Using Orthopantomograms

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Abstract

Impacted permanent mandibular canines can result in many complications and their early diagnosis is important. The aim of the present study was to determine the prevalence of impacted permanent mandibular canines in Karbala City/ Iraqi population. In this retrospective study, a total of 2840 orthopantomographs (OPG) were included in the research. The OPGs were taken routinely as a pre-treatment diagnostic purposes in the patients attending different dental clinics in Karbala. The prevalence, gender, type of impaction, side, angulation, depth, and the associated dental anomalies and pathologies were recorded. A total of 38 impacted permanent mandibular canines were found in 29 of the 2840 OPGs with 1.02% prevalence, with 12 being in males (41.38%) and 17 in females (58.62%). Impacted permanent mandibular canines were bilateral in only nine OPGs (31.03%), 55.26% were located on the right side, the vertical was the most dominant angulation (47.36%), and 50% were classified as Level A. Regarding the dental anomalies, 34.21% of impacted permanent mandibular canines were seen associated with impacted upper permanent canine, and 28.95% were associated with retention of lower deciduous canines, 10.53% for transposition, 10.53% for retention of deciduous molars, 7.89% for dilaceration, and 7.89% for transmigration. External root resorption of adjacent tooth found in 17.24%, followed by periodontal disease (13.79%), dental caries of the adjacent tooth (10.34%), dental tumor (6.89%), and the least was dentigerous cyst (3.45%). Impacted permanent mandibular canines prevalence was 1.02%. Early detection through radiographic evaluation is important for optimal management.

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Introduction

Impacted teeth are the teeth that remain incompletely or completely embedded in the jaw or mucosa for more than two years after the physiological time of its eruption [1], or it is the absence of a tooth in a dental arch after the complete root development, or at least it is missing in the arch six months after eruption of its contralateral tooth, and they are expected not to erupt based on its clinical and the radiographic features [2]. After the third molars,

permanent canines are the second most frequently impacted teeth and may lead to esthetic, functional, and orthodontic complications [3].

Regarding the mandibular canines, which normally erupt before the maxillary canines, they erupt labial to the primary canines, and this can create a more space in the mandibular arch. The mandibular canines should erupt prior to the premolars and usually erupt at about 10–11 years of age. It can lose their ability to erupt due to different angulations and positions in

the lower jaw [4]. The most impacted mandibular canines do not have symptoms, but some can cause aesthetic problems like labial or lingual positioning of the impacted canine, migration of adjacent teeth, resorption of adjacent teeth, caries of adjacent teeth, marginal bone resorption adjacent to the impacted canine area, infections, pain, cysts, or tumor [5,6] and this needs different treatment methods [7,8]. Regarding the causes of impaction of mandibular canines, there are some hypotheses, like the premature loss of deciduous teeth,

retention of deciduous canine, crowding, supernumerary teeth, and odontomas [9,10].

There are very few studies concerning the prevalence of occurrence of impacted permanent mandibular canines [11]. Early diagnosis of canine impaction on OPG is important for dentists, it can facilitate the treatment plan and assess the region for the surgical approach and the direction of the orthodontic force [12]. The aim of this research was to determine the prevalence of impacted mandibular permanent canine in Karbala City, Iraqi population and the most common associated anomalies and pathologies using orthopantomograms.

Material and Methods

In this cross-sectional retrospective study, a total of 2840 OPGs were included in the research. The OPGs were taken routinely as a pre-treatment diagnostic purpose in the patients attending different dental clinic in Karbala, Iraq. All OPGs had been taken using extra-oral digital Kodak 9000 imaging system with exposure time of 12.5s, current of 12 mA and voltage of 73 kV. The study design was approved by Al-Hussain University College, Department of Dentistry, and all the data including the patient's demographic information were kept confident.

The inclusion criteria are dentulous patients with permanent dentition within the age of 14 years and above with the presence of lower permanent impacted canine which are not likely to erupt. The exclusion criteria are patient with surgical extraction of mandibular canine, jaw fracture, patients with syndromes like down syndrome, or distorted OPGs with poor visibility.

From a total of 2840 screened OPGs images, 29 individuals with mandibular impacted canine were fulfilled the inclusion criteria. The data variables are gender (male/female), type of impaction (unilateral/ bilateral), side (left/right), angle (mesioangular, distoangular, horizontal, vertical), depth (A, B, C) [6], and the associated dental anomalies and pathologies were also recorded.

- level A, the crown of impacted canine is near the cervical line of the adjacent teeth.
- Level B, the crown of the impacted canine is between the root apices and cervical line of adjacent teeth.
- Level C, the crown of impacted canine is below the root apices of the adjacent teeth.

The associated dental anomalies are congenital missing lateral or first premolar, retention of deciduous canine, retention of deciduous molars, dilacerated impacted canine, presence of supernumerary tooth, association with

impaction of upper canine, transmigration, and transposition. The associated pathologies that appear radiographically are caries, periodontitis, dentigerous cysts, root resorption of adjacent tooth, and dental tumors like odontoma. All the data were collected, tabulated, and then statistically analyzed to assess the prevalence of impaction, gender, type of impaction, side, angulation, depth, and the associated dental anomalies and pathologies in a population of Karbala City, Iraq.

Results

A total of 38 impacted mandibular canine teeth were found in 29 of the 2840 OPGs with 1.02% prevalence (Table 1), with 12 being in males (41.38%) and 17 in females (58.62%), with a male to female ratio of 0.7-1. The mean age was 23 years for males and 18.13 years for females.

Impacted mandibular canine teeth were bilateral in nine OPGs (31.03%) and the others 20 (68.97%) were seen unilateral. Twenty-one (55.26%) of the impacted canines were located on the right side and 17 impacted canines (44.74%) were located on the left.

Regarding the distribution of mandibular canine impaction by angle (Figure 1, Table 2), the vertical was the most dominant angulation 18 (47.36%), followed by mesioangular 12 (31.59%), distoangular 8 (21.05%), and horizontal (0%).

In the present study, out of the 38 teeth, the depths of 19 (50%) canines were classified as Level A, 15 (39.47%) as Level B, and 4 (10.53%) were classified as Level C as seen in Table 2.

The dental anomalies associated with impacted mandibular canine are listed in Table 3. The most common anomaly was 13 (34.21%) impacted mandibular canines were seen associated with impacted upper permanent canine, and 11 (28.95%) were associated with retention of mandibular deciduous canines, 4 (10.53%) for transposition, 4 (10.53%) for retention of deciduous molars, 3 (7.89%) for dilaceration, and 3 (7.89%) for transmigration (Figure 2).

Among the pathologies associated with impacted mandibular canine, the most prevalent pathology was external root resorption of adjacent tooth found in 5 OPGs (17.24%), followed by periodontal disease found in 4 OPGs (13.79%), dental caries of adjacent tooth found in 3 OPGs (10.34%), dental tumor was found in 2 OPGs (6.89), the least to be found was dentigerous cyst found only in 1 case (3.45%).

Discussion

The impaction can occur due to tooth bud malposition, bath of eruption obstruction, increase in bone deposition, trauma, premature loss of the primary teeth, prolonged retention of the

primary teeth, childhood diseases, or hereditary factors, but the exact cause is not known till now [13].

In the present study the prevalence of impacted mandibular canine was 1.02%. Alhussaini et al (2025) [14] study in Baghdad, Iraq found that, 20 patients of 1000 had impacted mandibular canines (2%). In Shiri and Hegde (2026) [15] study, they found that of 2,500 subjects, only 50 presented with mandibular canine impaction (2%). A value of 1.36% was found in a study conducted in Nigeria of 1250 patients with 17 patients having impaction of mandibular canines [16]. The study conducted by Yavuz et al (2007) [2] in Ataturk University, they found an incidence of 1.29%, and the study of Agastra et al (2023) [17] in University of Turin, Italy found a prevalence of 1.7%. These values are more than that found in Chinese population (0.3%) [18], and Turkish population (0.92%) [19]. These differences between studies concerning the prevalence of the occurrence of mandibular canine impaction could be due to different methodology used.

The present study found that more female (17 females) than male patients (12 males with impacted mandibular canines. This comes in agreement with that of Alhussaini et al (2025) [14] study (12 females and 8 males), Shiri and Hegde (2026) [15] study (28 females and 22 males), Sanu et al (2012) [16] study (10 females and 7 males), and Abdulla (2023) [20] study (8 females and 3 males). In. on the contrary, the Agastra et al. (2023) [17] study found more male patients (14 males) than female patients (11 females). This sex difference may be a result of sex-related differences in growth patterns.

Impacted mandibular canine teeth were bilateral in (31.03%) of the cases and the others (68.97%) were seen unilateral. Alhussaini et al (2025) study [14] found that the bilateral impaction (25%) was less common than the unilateral impaction (75%). Abdulla (2023) study [20] also found that the bilateral impaction (18.18%) was less common than the unilateral impaction (81-82%). In contrast, Agastra et al (2023) [17] study found that the percentage of bilateral permanent mandibular canine impaction (32.43%) was nearly equal to that of unilateral impacted (35.14%).

In the present study (55.26%) of the impacted canines were located on the right side and (44.74%) were located on the left side. More impacted canines located on the right side than on the left side were also found by Sajani and King (2018) [18] and Yavuz et al (2007) [2] studies. Unlike these studies, Agastra et al (2023) [23] study found more impacted mandibular canines located on the left side of the jaw than on the right side (21 impacted canines on the

left side and 16 canines on the right side). Shiri and Hegde study (2026) [15] study also found a left-side predilection.

Regarding the distribution of mandibular canine impaction by angle, the vertical was the most dominant angulation (47.36%), followed by mesioangular (31.59%), and distoangular (21.05%). Fifty percent were classified as Level A, 39.47% as Level B, and 10.53% as Level C. In Sana'a city, Yemen (2021) [21], the mesioangular was seen the most predominant angulation (66.3%), followed by the vertical (23.7%), horizontal (8%) and distoangular (2%), and the most dominant depth was level B (59.8%), followed by level C (24.9%), and level A (15.3%). The most common anomalies were 13 impacted mandibular canines (34.21%) seen associated with impacted upper permanent canine, and 11 (28.95%) were associated with retention of deciduous canines, 4 cases (10.53%) for transposition or retention of deciduous molars, and 3 (7.89%) with dilaceration or transmigration. In Yemen city (2021) [21] the multiple impaction form 1.5%, retention of deciduous canine form 29.5%, transposition 27.5%, retention of deciduous second molar 0.3%, supernumerary tooth 1%, and transmigration 15.3%. In Sudan city (2014) [22], the multiple impaction form 2%, retention of deciduous canine 81.6%, retention of deciduous second molar 6.2%, and transmigration 4%. In Shiri and Hegde study (2026) [15], the dental anomalies were present in 21 subjects (42%), retained deciduous canine (74%), hypodontia (12%), supernumerary teeth (6%), and transpositions (4%).

Among the pathologies associated with impacted mandibular canine, the most prevalent pathology was external root resorption of adjacent tooth found in 17.24%, followed by periodontal disease 13.79%, dental caries of adjacent teeth 10.34%, dental tumor was found in 6.89%, and the least to be found was dentigerous cyst found only in 3.45%. Yu et al (2019) [23] found three of 14 cases of impacted mandibular canine were associated with dental cyst and one case was accompanied by a dental tumor. A rare case report of dentigerous cyst associated with impacted mandibular canines was seen by Vasudev et al study (2025) [24]. All these differences could be due to different methodology, different populations like orthodontic patient populations or the general population, different sample sizes, and the different racial groups.

Conclusion

The prevalence of impacted mandibular canine teeth was 1.02%, females, unilateral impaction, and impaction in the right side was predominant. The vertical was the most dominant angulation followed by mesioangular, and

distoangular. No impacted canines were seen with horizontal angulation. Level A was predominant, followed by Level B, and Level C.

Regarding the dental anomalies, 34.21% of impacted mandibular canines were seen associated with impacted upper permanent canine, and 28.95% were associated with retention of deciduous canines, 10.53% for transposition and for retention of deciduous molars, 7.89% for dilaceration and for 7.89% for transmigration. External root resorption of adjacent tooth found in 17.24%, followed by periodontal disease in (13.79%), dental caries of adjacent tooth found in (10.34%), dental tumor was seen found in (6.89%), and the least to be found was dentigerous cyst found only in (3.45%).

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Conflict of Interest

All authors declare no conflict of interest.

Data Availability

Data are available upon reasonable request.

Author Contributions

MHA contributed to collecting the OPGs of patients attending different dental clinic in Karbala/Iraq and to the study design. AKK and ASA contributed to the data analysis, interpretation of results, and revision and proofreading of the manuscript. All authors read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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Table 1. The number and percentage of patients with or without mandibular impacted canines in the studied population in each gender.

Anomalies	Number	Percent
Congenital missing Lateral	0	0
Congenital missing first premolar	0	0
Retention of deciduous canine	11	28.95
Retention of deciduous molars	4	10.53
Dilacerated impacted canine	3	7.89
Presence of supernumerary tooth	0	0
Associated with impaction of upper canines	13	34.21
Transmigration	3	7.89
Transposition	4	10.53
	38	100

Table 2. Type of angulation and depth of impaction of impacted mandibular canines.

Angulation	No. of teeth	Percentage	Depth of impaction	No. of teeth	Percentage
Mesioangular	12	31.59	Level A	19	50
Distoangular	8	21.05	Level B	15	39.47
Vertical	18	47.36	Level C	4	10.53
Horizontal	0	0			
	38	100		38	100

Table 3. Different types of associated anomalies with the impacted mandibular canines.

Gender	Criteria				Total (No.&%)	
Male	No impaction	Number	1005	With impaction	Number	1017
		Percentage	35.39%		Percentage	0.42%
Female	No impaction	Number	1806	With impaction	Number	1823
		Percentage	63.59%		Percentage	0.6%
Total	1811			29		2840
(No.&%)	98.98%			1.02%		100%



Figure 1. Middle segments of OPGs shows (A) Level A of mesioangular impacted lower left canine with retained deciduous. (B) Bilateral distoangular impacted lower canines associated with impacted upper canines (C). Level B of vertically impacted lower left canine with transposition between the lower central and lateral incisors.

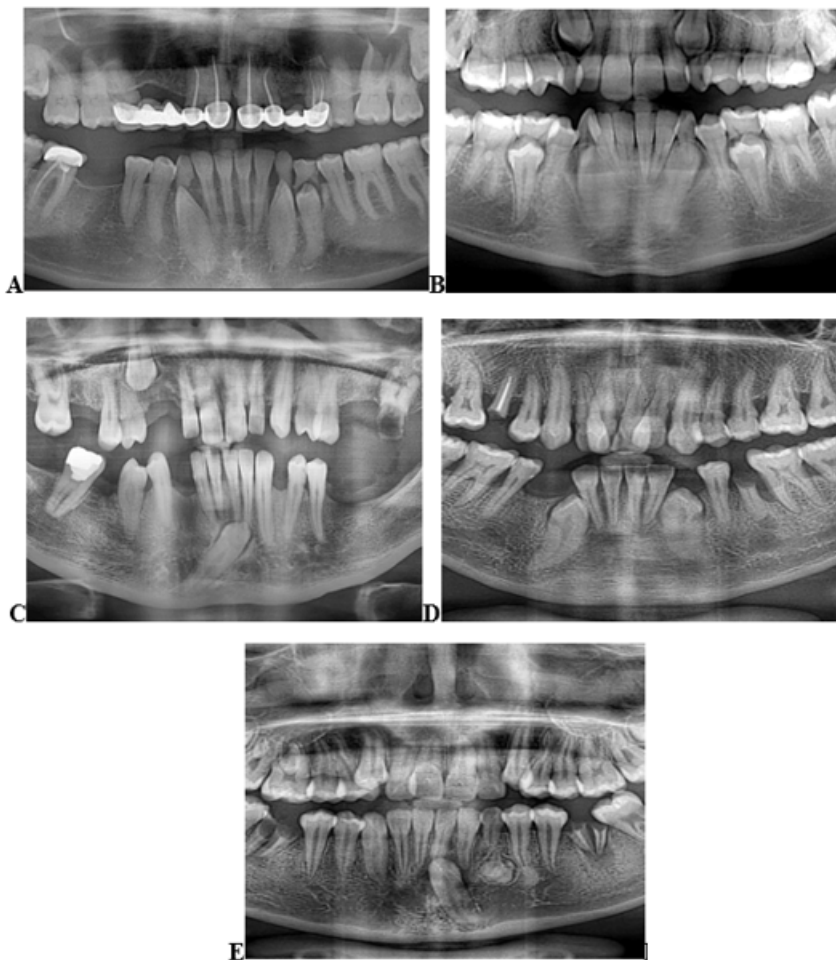


Figure 2. Middle segment of OPGs shows (A) Impaction of lower canines and left first premolar with retention of deciduous canines and left first deciduous molar. (B) Impaction of lower canines with impaction of second premolars and retention of second deciduous molars. (C) Level C of transmigrated impacted lower right canine across the midline. (D) Dilaceration of impacted lower canines. (E) Impacted lower canine causing resorption of the apex of lower central incisor and associated with odontoma.