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Prevalence and Common Hard Tissue Pathology of Impacted Canines in a Libyan Population Sample: A Retrospective Study Using Digital Panoramic Radiography

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Abstract: ***Background: Canine impaction (CI) is relatively common, ranging from 0.8-3.6%. Unilateral impaction is more common than bilateral impaction and impaction is more common in the palate than in the buccal position. Diagnosis of complications such as root resorption of the lateral incisors, transmigration, cyst, or tumor will influence further treatment decisions. Aim: This study aimed to determine the prevalence of CI in a Libyan population sample using digital panoramic radiographs (PRs) and to identify associated hard tissue pathologies. In addition to the study of gender, position, aspect, and the phenomenon of transmigration. Material and Methods: For this evaluation, 1566 digital PRs from the population of Tripoli, Libya were retrospectively collected. Selected PRs were evaluated using Microsoft Excel and the information was collected and studied (Microsoft Office 2013). Data were validated using the chi-square analysis method. Results: Examination of the digital PRs of 1, 566 patients revealed that 58 (3.7%) cases of canine impactions (CIs) in the total study population had at least one CI, with a female to male ratio of 1.3: 1. Root resorption of adjacent incisors was the most common pathology in 17.2% of hard tissues. Conclusion: The prevalence of CI was high in the study population. Maxillary impacted Canine (Max IC) was more common than mandibular impacted canine (Mand IC) and was more common in females than in males. Unilateral CI had a higher prevalence than bilateral CI. CI positions are usually palatal in the maxilla and labial in the mandible.***

Keywords: Prevalence, canine impaction, hard tissue pathology, digital panoramic radiography, Libyan population

1. Introduction

Permanent canines play an important role in cosmetic, functional, and occlusal protection [(1)]. An impacted canine tooth is defined as a tooth when it does not erupt within 6 months of complete root formation or is absent from the dental arch at the eruption stage [(2)]. The first signs of development appear at 30 weeks of age, calcification is complete at 4 to 5 months, and a normal eruption occurs at 11 to 12 years of age [(3)]. CIs are relatively common and have been extensively described in the literature in various populations ranging from 0.8 to 3.6% of the general population [(4)]. The prevalence of impacted upper canines ranged from 0.9% to 3.3% [(5)]. CI is more common in women than men and more common in the maxilla than in the mandible [(6)]. Mandibular canines are affected less frequently than maxillary canines [(7)].

Bilateral CI is not as common as unilateral CI. CI occurs in the palate roughly 50 times more frequently than in the labial vestibule [(8)]. Although the precise cause of this anomaly is unknown, potential causative factors include trauma, genetics, lengthy canine eruptive lines, the early loss of deciduous teeth, incompatibility between tooth sizes, insufficient length of the dental arch, and odontomes.[(9)] Dentigerous cyst, adenomatoid odontogenic tumour, calcifying epithelial odontogenic tumour, ameloblastoma, odontogenic myxoma, external and internal root resorption of impacted teeth, external root resorption of adjacent teeth, transmigration, ectopic eruption, periodontitis, and referred pain are among the associated pathologies reported to be related to CI [(10)]. Intraosseous migration of unerupted teeth across the midline is a rare phenomenon known as tooth transmigration, and transmigration is more common in the mandible. The frequency of this phenomenon has been reported to range from 0.8% to 3.6% [(11)]. The cause of the transmigration is unknown. However, the most widely accepted explanation is the abnormal displacement or deviation of the tooth bud during development [(12)].

Clinical examination and moderate radiography are the main tools for making an accurate diagnosis and planning an appropriate treatment [(13)]. Diagnosis of complications such as resorption of the lateral incisor root, root swelling, or ankylosis will influence future treatment decisions [(14)]. Impaction of maxillary and mandibular canines is a common clinical condition that usually necessitates an interdisciplinary approach to therapy [(15)]. However, for impacted canines, several treatment options are available, including surgical removal, exposure and orthodontic alignment, transplanting, and monitoring [(16)].

2. Materials and Methods

A total of 1566 digital PRs were collected from patients who visited Dar Alfardous dental facility and Military Hospital in Tripoli, Libya, between January 2021 and August 2022. The PRs were obtained from the radiology unit's archives. All of these retrospectively recorded digital PRs were thoroughly studied and evaluated by two specialist investigators in a dark room using an appropriate X-ray viewer to determine the distribution and frequency of CI, their aspect, position and associated pathosis. Microsoft Excel was used to tabulate and analyzes the acquired data (Microsoft Office 2013). The gathered data were analyzed using SPSS® 26 (IBM, USA) to explain the quantitative data, which included mean and standard deviation, and the qualitative data, which included cross-tabulation tables, bars and pie chart were used. A chi-square analysis test was used to evaluate the collected data. A p-value of 0.05 or less was considered significant. Data were collected anonymously and confidentially without identification. Dar Alfardus Clinic and Military Hospital's Board of Directors has ethical approval.

3. Result

Digital PRs of 1566 patients were examined and 58 (3.7%) cases of CI were found in the entire study sample showed at least one or more impacted canines (Fig1).

Among the subjects of the entire study sample, the prevalence of CI in females was 33 cases (57%) and in males 25 cases (43%) and was thus considerably higher in females with female to male ratio of 1.3: 1 (Fig 2).

Out of 58 digital PRs with impacted canines, there was a higher prevalence of Max IC44 (75.8%) compared with MandIC14 (24.1%) (Fig 3).

Among 58CI, left sides impacted canines were most commonly encountered 24 (41.3%), followed by rightCI21 (36.2%) and both sides CI (right and left) 13 (22.4%) (Fig 4)

A total of 58 digital PRs presented with CI had either unilateral or bilateral impactions. The number of unilaterally impacted canines was 46 (79.3%), which was higher than the number of bilaterally impacted canines, which was12 (20.6%). However, the association between side and location of impacted canines, unilaterally CI was most frequently found in the maxilla 36 (81.8%) and 8 (18.2%) subjects with Max IC had bilateral impactions. While there were 10 (71.4%) participants with unilateral Man IC, and 4 (28.6%) of them had bilateral CI which was not statistically significant (p = 0.13) (Table 1).

Among 58CI, the palatally position of impacted canines was most commonly encountered by 32 (2%) whilst 26 (1.7%) had labially position. Regarding the association between position and location of CI, the palatally position of CI was the most frequently observed in maxilla 32 (73%) and 12 (27%) labially positioned in the same arch. Whilst no palatally position of Mand IC has been recorded in the entire sample, but labially position of M and IC was found to be 14 (24.1%). However, the palatally position in both maxilla and mandible 32 (55.2%) was higher than in labially position 26 (45%) (Table2).

The prevalence of the transmigration phenomenon among CI was 5 (0.32%). However, 3 (60%) cases of transmigrated impacted canines were found in males and 2 (30%) cases were found in females. There was no statistically significant gender (p = 0.45) (Table 3).

A total of 1566 digital PRs were diagnosed with CI out of which 17 (29.2%) were associated with pathologies while 41 (70.7%) subjects had no pathology.12 (71%) of Max IC and 5 (29%) of M and IC had associated with hard tissue diseases. Root resorption of adjacent incisors was the most common hard tissue pathosis 10 (17.2%), followed by carious lesions 3 (5.2%), bone resorption 2 (3.4%) and odontome 2 (3.4%) were associated with hard tissue pathosis (Fig 5).

4. Discussion

This study aimed to determine the prevalence of CI and detect their associated oral hard tissue pathosis in a sample of the Libyan population by using digital PRs. In addition to studying gender, location, sides, position and transmigration phenomenon. Many studies have evaluated the prevalence of CI among different populations and reported significant differences in their results [(2)]. In our study, the prevalence of CI was 3.7% which falls within the range of 1.4% to 4.3% reported by other studies. The prevalence in our study was consistent with a study in an Israeli Arab population that reported a 3.7% higher prevalence of CI in orthodontic patients [(7)].

CIs are more common in female than male patients with a wide range of racial populations [(8)]. In this presented study, female to male ratio was 1.3:1 which means that the CI were more common in females than in males which may be attributed to the smaller cranium in female patients. This finding was in agreement with many previous studies but in disagreement with Almarhoumi (2021) [(1)] who conducted a study on 7466 Saudi patients and found that both genders exhibited almost equal distribution of impacted canines.

Max IC is more common than M and IC, and the impaction ratio of the mandibular canine teeth were higher than previously reported in the literature [(16).] In this study, there was a high prevalence rate of Max IC was found to be 75.8% compared to Mand IC at 24.1%. These findings were consistent with Kamiloglu (2014) [(4)] who reported that Max IC occurred significantly more frequently than M and IC in the study conducted on PRs of 453 patients. Furthermore, many studies have reported that mandibular canines are less frequently impacted than maxillary canines or it is relatively rare.

Unilateral CI predominated bilateral CI both in the maxilla and the mandible with the most incidences occurring on the left side of the maxilla [(1)]. In our presented study, the prevalent rate of unilaterally CI was 46 (79.3%) and found to be significantly higher than the bilaterally IC 12 (20.6%). Furthermore, unilaterally CI was most frequently found in the maxilla 36 (81.8%). our findings are in line with Altan

(2020) [9] and also with Gashi (2014) [12] but in disagreement with Chung (2011) [17] who reported that bilateral CI is more frequent than unilateral CI. Most of the canines were impacted on the palatal position. Max IC more often existed palatally than buccal position [6]. On the other hand, M and IC are also more likely to be found on the labial position of the dental arch than Max IC [16]. Our presented study revealed that the palatal position of impacted canines was more commonly observed in 32 (2%) which was supported by many previous studies. Moreover, the association between the position and location of impacted canines showed that the palatal position of CI was most frequently observed in the maxilla at 73%. Whilst, the labial position of M and IC was observed at 27%. These findings were in agreement with Grisar (2019) [14] and also with Alrwuili studies (2016) [13] but in disagreement with Sajnani (2014) [18] who conducted a study on 533 subjects with Max IC and he found that labial position of impacted canines demonstrated a slightly higher incidence 49.8% compared to palatally impacted canines 43.9%.

Several studies have been conducted to determine the prevalence of transmigration among various communities and ethnic groups, which has been estimated to be between 0.1 and 0.34% [4]. In our study, the prevalence of the transmigration phenomenon among CI was 0.32% and slightly more in males. However, many studies have supported our result that the transmigration of CI was a rare phenomenon.

Any impacted teeth should be carefully examined because they are associated with various pathologies when they become impacted [10]. In our study, 71% of Max IC and 29% of M and IC had associated with hard tissue pathosis which may be attributed to the high prevalence rate of Max IC in most studies. In our presented study, root resorption of adjacent lateral incisors was the most common pathosis at 17.2% followed by carious lesions at 5.2%, bone resorption at 3.4%and odontome at 3.4%. However, lateral incisor root resorption is a well-recognized phenomenon caused by impacted canines which was supported by many studies.

5. Conclusion

Our finding revealed a significant prevalence rate of CI 3.7% in a sample of the Libyan population. Max IC was more prevalent than M and IC as it was more frequently seen in females than in males. Bilateral CI was less prevalent overall than unilateral CI. The findings of our study showed that the most common positions for an impacted canine are labially in the mandible and palatally in the maxillary arch. Males were slightly more likely than females to exhibit the transmigration phenomenon, which was a low percentage among CI. To make an accurate diagnosis, choose the right modality of treatment and to early detect associated pathosis, modern radiography images are crucial. To maintain the healthy condition of asymptomatic impacted teeth, it is crucial to undergo routine oral examinations and follow-ups. Future research is needed to assess the etiology and transmigration of CI.

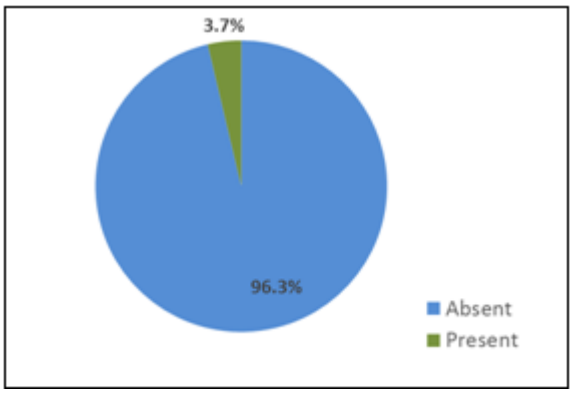

Figure 1: Pie chart representing the prevalence rate of impacted canines in the entire study sample

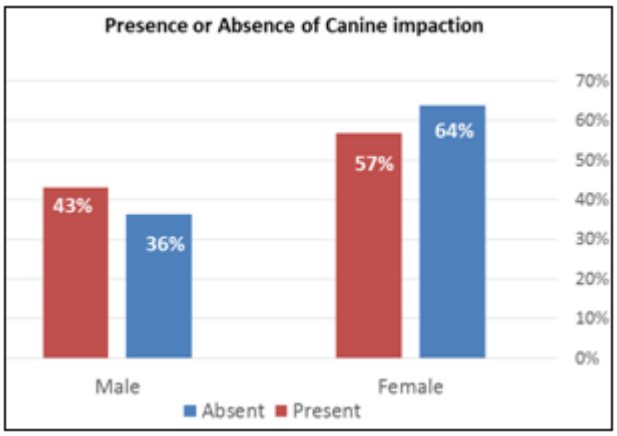

Figure 2: Bar graph representing the percentage distribution of canine impactions in the entire study sample according to the gender

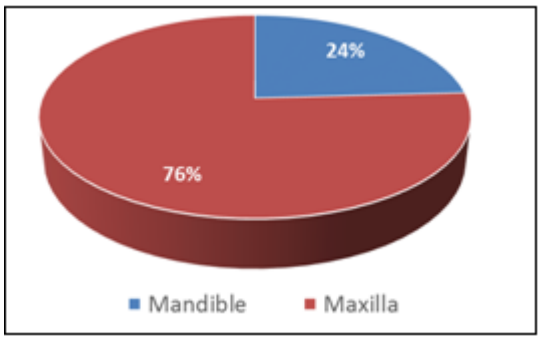

Figure 3: Pie chart shows distribution and frequencies of impacted canines by location

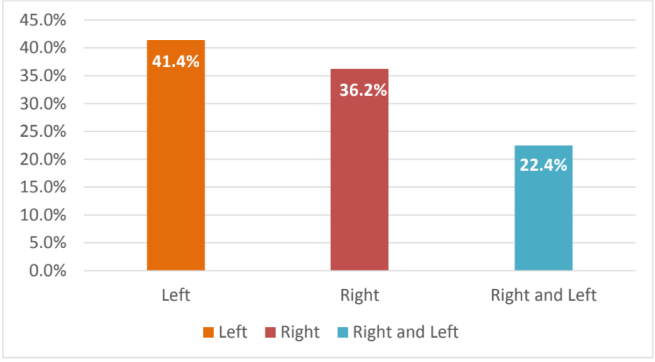

Figure 4: Bar graphs representing percentage distribution of impacted canines by side (right, left, both side)

Table 1: Association of location with presence of unilateral or bilateral impacted canine

Unilateral or bilateral impaction	Maxilla		Mandible	
	No.	%	No.	%
Bilateral	8	18.20%	4	28.60%
Unilateral	36	81.80%	10	71.40%
Total	44	100.00%	14	100%

Table 2: Association of location with the position of impacted canines

Position	Maxilla		Mandible		Both	
	Count	%	Count	%	Count	%
Palatally	32	73%	0	0%	32	55%
Labially	12	27%	14	24.14%	26	45%
Grand Total	44	100%	14	100%	58	100%

Table: 3 Association of presence or absence of transmigration phenomenon in accordance to the gender

Transmigration	Male		Female		Both	
	Count	%	Count	%	Count	%
Absent	22	42%	31	58%	53	91%
Present	3	60%	2	40%	5	9%
Grand Total	25	43%	33	57%	58	100%

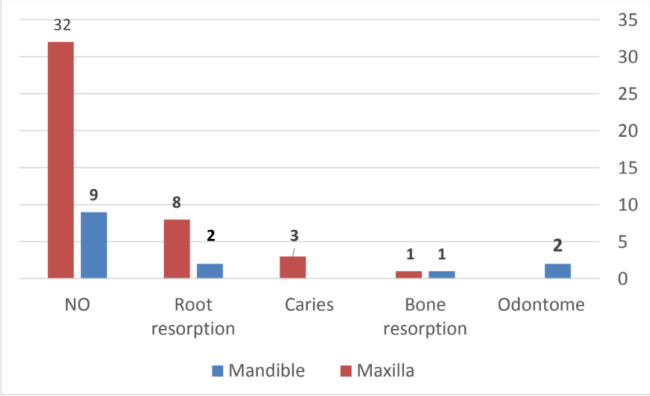

Figure 5: Bar graphs shows association between hard tissue pathologies and location of canine Impaction

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