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Prevalence of canine impaction in the western province of Saudi Arabia: A cross-sectional survey

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Abstract

BACKGROUND/AIM: Canine tooth impaction could have a negative influence on the stomatognathic system and could make it difficult for clinicians to manage malocclusions. The aim of this retrospective study was to investigate the prevalence of canine impaction, which could be a cause of malocclusion, in the population in the western province of Saudi Arabia.

METHODS: A retrospective analysis of digital orthopantomograms (OPGs) of 400 patients aged 12–40 years, who are citizens of Saudi Arabia residing in the western province and who presented for treatment at the dental clinics of Batterjee Medical College, Jeddah, Saudi Arabia were included. The OPGs and dental records of these patients were reviewed for canine impaction and were categorized based on age, gender, and type of impaction.

RESULTS: The prevalence of patients that exhibited canine impaction was found to be 4%. Males had a significantly higher percentage of prevalence than females ($P < 0.016$), and impaction was significantly higher among patients aged below 18 years ($P < 0.001$). Moreover, the most commonly observed impaction was mandibular canine impaction (87.5%).

CONCLUSIONS: Prevention of malocclusion and maintenance of a normal dentition (better aesthetics and chewing) necessitates early detection of impacted canines.

Keywords:

Canine impaction, health care planning, malocclusion, prevention

Introduction

Tooth impaction is defined as the persistence of a tooth below the bone after the usual period for the eruption has passed or the failure of a tooth to erupt into the oral cavity. Impaction occurs when the usual development of a tooth is hindered or interrupted.^[1] Delayed eruption, primary retention, submerged teeth, impacted teeth, etc., are all terms used to describe impaction in clinical practice. When the opposing canine has erupted for at least six months with full root development or when the canine eruption is interrupted after full root development,

the canine is regarded as impacted.^[2] Canine impaction in number and position usually results in problems in maxillary and mandibular arch length, crowding, and occlusion, which may influence orthodontic treatment planning.^[3] The most common tooth that is impacted after the third molar is the maxillary canine.^[4] Impaction of the maxillary canines is a clinical situation that is experienced rather frequently, particularly by orthodontists.

Canine impaction is believed to have multifactorial etiology, including those that are localized, systemic, or genetic.^[3-5] Impaction of the maxillary canines is a clinical situation that is experienced quite frequently, especially by orthodontists. There are a variety of possible difficulties

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that can arise as a result of canine impaction. Clinical and radiographic examinations are the lynchpin of impacted canine management, as they facilitate the identification and localization of the impacted teeth. Impaction of the maxillary canine typically calls for multidisciplinary management. Various treatment choices are available for canine impaction, including no treatment, an interceptive approach, extraction, autotransplantation, as well as surgical exposure, and orthodontic positioning.^[6,7] Early detection and prevention of possible impaction is the preferred therapeutic approach.^[8] Surgical exposure and orthodontic alignment may be necessary if preventative measures fail. The position of the impacted canine within the dental arch could determine the need for surgical intervention strategies and other orthodontic considerations.

Canine impaction has been reported to have a prevalence of between 0.8% and 9.5%, depending on the population or ethnicity under study.^[9-11] In order to better understand demographics and allocate and manage local dental health resources, it is essential to investigate and report the incidence of canine impaction for each population separately due to this diverse pattern. Reports of canine prevalence in Saudi Arabia differ across regions and populations. It varied from a minimum of 1.44% up to a maximum of 10.1%.^[12,13] The previous study conducted in the Jeddah region was in 2012, which reported a prevalence of 3.3%.^[14] Exploring the frequency of canine impaction in the western province of Saudi Arabia would be advantageous for an array of objectives, including the minimization of the wide-range bias of canine impaction in the Kingdom and the better allocation of local dental health care resources. Thus, this study was conducted to examine the prevalence and patterns of canine impaction in the Saudi population in the western province of Saudi Arabia.

Materials and Methods

This study was a retrospective study conducted at the dental clinics of Batterjee Medical College. We examined the orthopantomogram (OPG) images of patients who attended the dental clinics from June 2021 to December 2022. Permission to examine the OPG was taken from the Head of the Dentistry Program and Clinical Director. We only included the OPG images of Saudi nationals aged between 12 and 40 years and those who were permanent residents of the western province of Saudi Arabia. The exclusion criteria included patients who exhibited one or more of the following aspects: any disease, trauma, or fracture of the jaws that may affect the normal growth of permanent dentition. Records of patients who presented with hereditary conditions or syndrome that could cause dental anomalies, such as Down's syndrome or cleidocranial dysostosis, were also excluded. Moreover,

dental records and OPGs were reviewed for maxillary and mandibular canine impaction.

A minimum sample size of 376 was determined to be sufficient based on previous studies conducted in the Kingdom. We decided to include a sample of 400 for our analysis. Digital OPGs of these patients were examined in a standard manner under good lighting conditions as well as standardized screen brightness and resolution. If patients had permanent dentition and OPGs revealed completely developed roots for the impacted canine, then their data were included in the evaluation. OPGs underwent a comprehensive analysis by dentists who possessed a high level of training and experience. Two dentists participated in the calibration sessions and their responses were compared with those of an experienced faculty in the dentistry program. Good reliability was observed in the pre-study inter-rater reliability agreement test ($Kappa = 0.89$). Furthermore, OPGs were evaluated without magnification using a transparency projector in a controlled environment with steady lighting or a constant contrast level for OPGs. In this study, a tooth was considered to be impacted if it was prevented from erupting normally by certain physical barriers, such as the teeth or bone or soft tissue, that lie in its route of eruption.^[6,7] If a tooth has failed to emerge after a particular amount of time (two years), it was classified as impacted.^[6]

Statistical analysis and data management

The data pertaining to each patient were first entered in Microsoft Excel (Microsoft Office 2010, Mac OS). After cleaning and creating uniformity, the data were then transferred to SPSS software (IBM SPSS Statistics for Mac, Version 23.0, Armonk, NY: IBM Corp). An independent biostatistician was responsible for the statistical analysis. The statistical analysis did not include patient records with absent or incomplete information. Frequencies, percentages, means, and standard deviations were all utilized to provide descriptive statistics. The percentage of impacted canines that were affected was compared across several categorical variables using Pearson's Chi-squared test. Statistical significance was assumed at a P value of less than 0.05 ($P < 0.05$).

Results

The analysis revealed that 233 (58.25%) were males and 166 (41.75%) were females. Canine impaction was found among 16 patients, which implies a prevalence of 4%. Further, it was found that males had significantly higher proportions (6%) of canine impaction compared to females (1.2%), ($P = 0.016$). In addition, when we assessed the prevalence based on the age of the patient, canine impaction was significantly higher in patients

aged below 18 years (15.4%) compared to those aged above 18 years (1.8%) ($P < 0.001$) [Table 1].

When we assessed the type of canine impaction, it was found that the mandibular canine was the most commonly impacted canine (87.50%) compared to the maxillary canine (6.25%) [Figure 1]. There were no statistically significant differences observed in the distribution of type of canine impaction based on the gender of the patients ($P = 0.114$). In addition, we found that patients aged below 18 years had comparatively more frequent occurrence of mandibular canine impaction compared to those aged above 18 years ($P < 0.001$) [Table 2].

Discussion

Orthodontic patients have been reported to have high rates of dental anomalies, including canine impactions.^[15] Inadequate consideration of these dental conditions can complicate orthodontic treatment; therefore, their

presence should be thoroughly investigated during orthodontic diagnosis and carefully considered during treatment planning. Thus, this study was conducted to assess the prevalence of canine impaction that could cause malocclusion. Further, canine impaction may be expressed with different degrees of severity, from the mildest to the most severe form. Several studies have suggested that canine impaction has been attributed to genetics, absence of eruption guidance from anomalous lateral incisor, long and tortuous path of eruption, coexisting hypodontia, agenesis, aplasia, and supernumerary teeth.^[16,17] The prevalence of canine impaction reported in this study was 4%, which is similar to the results of an earlier study^[18] and another new study^[12] conducted in Saudi Arabia. The prevalence of maxillary canine impaction in females was 0% in this study, which is similar to the prevalence estimates in other studies reported in the literature. Reports from different countries reveal that the prevalence of canine impaction varies widely. This prevalence was reported to be 13.7% in Greece,^[19] 14.1% in Finland,^[20] 16.8% in India,^[21] 44.1%

Table 1: Prevalence of canine impaction based on age and gender

	Canine impaction		Total	P
	Absent	Present		
Gender				
Female				
n	164	2	166	0.016
%	98.8%	1.2%	100.0%	
Male				
n	219	14	233	
%	94.0%	6.0%	100.0%	
Age				
≤ 18 years				
n	55	10	65	<0.001
%	84.6%	15.4%	100.0%	
>18 years				
n	328	6	334	
%	98.2%	1.8%	100.0%	

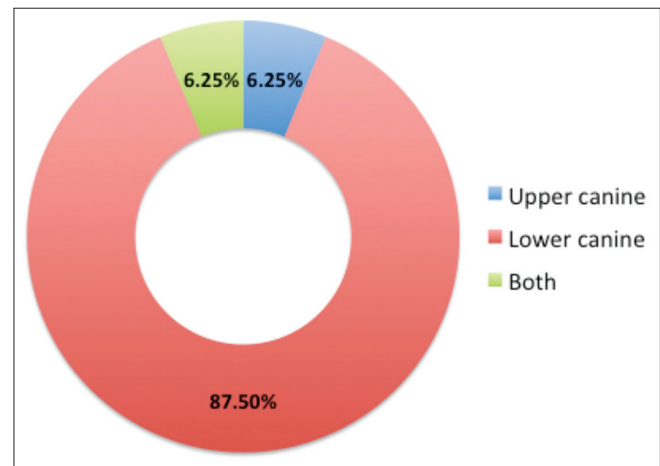


Figure 1: Different types of canine impaction

Table 2: Type of impaction based on age and gender

	Type of impaction				Total	P
	No impaction	Maxillary canine	Mandibular canine	Both		
Gender						
Female						
n	164	0	2	0	166	0.114
%	98.8%	0.0%	1.2%	0.0%	100.0%	
Male						
n	219	1	12	1	233	
%	94.0%	0.4%	5.2%	0.4%	100.0%	
Age						
≤ 18 years						
n	55	1	9	0	65	<0.001
%	84.6%	1.5%	13.8%	0.0%	100.0%	
>18 years						
n	328	0	5	1	334	
%	98.2%	0.0%	1.5%	0.3%	100.0%	

in Iran,^[22] and 28.3% in Hong Kong.^[23] Moreover, reports from certain western provinces in Saudi Arabia, such as Jeddah and Medinah, have reported a prevalence of 21.1% and 2.5%, respectively.^[24,25] The diagnostic criteria used to define impaction and recruitment of research participants, such as various age groups and sample sizes, can account for these differences in the prevalence of impacted teeth across studies.

From the orthodontic management viewpoint, canine impaction is an important consideration for preventing malocclusion and restoring esthetics. Canine impaction is a topic that has received a lot of attention from researchers in Saudi Arabia. Our results revealed that males had significantly higher percentages of canine impaction compared to females. This is different from previous study findings, which reported no gender differences in the prevalence of canine impaction.^[26,27] In contrast to our study findings, shreds of evidence reveal that maxillary canine impaction is higher among the female population.^[28] By identifying its precise location, orthodontists can better assess whether it is preferable to reveal and orthodontically align the impacted canine or whether its removal would be more beneficial. Based on previous research evidence, it appears that males are more likely to exhibit maxillary canine palatal impaction than females, who are more likely to experience canine buccal impaction.^[29] Moreover, female patients may be more susceptible to canine buccal impaction because of the shorter arch length that results from a smaller cranium and mandible compared to male patients.^[30]

Researchers have been attempting to determine which dentoskeletal characteristics are most strongly associated with a future case of maxillary canine impaction for some time.^[31,32] Mercuri *et al.*^[33] found that horizontal and prognathic growth was present in patients with impacted canines, but they found no association between palatally impacted canines and buccally displaced canines and subsequent skeletal abnormalities. On the other hand, Basdra *et al.*,^[34,35] in their multiple studies, demonstrated that 33.5% of Class II division 2 malocclusions and 9% of Class III patients were associated with canine impaction. Further, canine impaction was found to be three times more common in hypodivergent patients than in normal individuals, further supporting the link between hypodivergence and vertical craniofacial features in another study by Sacerdoti and Baccetti.^[36]

A three-dimensional assessment of space is necessary for cases of impacted canines. Larsen *et al.*^[37] discovered that patients with impacted canines had a markedly enlarged transversely enlarged maxilla but that this was sagittally and vertically smaller than subjects without canine impaction. Several prognostic markers for predicting the complexity of treatment of impacted canines have

been described in the literature, as orthodontic alignment of impacted canines to their normal position may require extensive and lengthy treatment.^[38-40] However, predictions of success are currently grounded primarily in clinical experience and anecdotal evidence.

A few limitations of this study should be highlighted before interpreting the findings. First, one could argue that the selected sample could only represent a limited population. The dentistry program in our institution receives patients not only from the city of Jeddah but also from the surrounding suburban areas as well as neighboring cities. Therefore, it is fair to state that the selected sample was representative of the western province of Saudi Arabia. Second, in this research, participation was limited to only subjects who had recorded dental records that included OPGs. Third, due to a lack of easily accessible diagnostic tools, like radiographs and/or comprehensive orthodontic documents, the labio-lingual positions of impacted canines were not investigated in this research; thus, we were unable to classify impaction (e.g., partial or fully impacted). Exposing the patient to radiation to evaluate the canine position with no intention of treatment would be unethical.

Conclusion

In this study, we found that canine impaction was common among the population in the western province of Saudi Arabia. Canine impaction was significantly higher in the mandible than in the maxilla, and males had higher percentages of canine impaction than females. The early detection and treatment approach of impacted canines among affected individuals is vital to prevent a variety of problems that may arise during the impaction of canine teeth. Awareness, early detection, a proper diagnostic test, and multiple treatment approaches are required to prevent different sequelae due to canine impaction. Therefore, it is crucial to thoroughly evaluate the long axis of the impacted canines to determine the best course of therapy. We suggest that future research utilizes cone-beam computed tomography to evaluate the severity and treatment index of impacted canines for comparison with the results of the present study.

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Conflicts of interest

There are no conflicts of interest.

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