Journal of Dental Specialities 2024;12(1):36–39

Content available at: https://www.ipinnovative.com/open-access-journals

Journal of Dental Specialities

Journal homepage: https://www.jdsits.in/

Original Research Article

Determination of the position of impacted maxillary canine – A panoramic radiographic study

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ARTICLE INFO

Article history:
Received 06-02-2024
Accepted 07-03-2024
Available online 04-04-2024

Keywords:
Impacted maxillary canine
OPG
CBCT
Angulation method

ABSTRACT

Background: Maxillary canines are one of the most common impacted teeth. The objective in localization of an impacted canine is to be able to decide such a radiographic technique which has minimal radiation dose, cost and minimum superimpositions. Panoramic radiograph, being a screening radiograph, can satisfy the above needs. Taking this into consideration, the present study was done to evaluate the reliability of panoramic radiograph in localization of impacted permanent maxillary canines, when compared to cone-beam computed tomography.

Materials and Methods: OPG and CBCT images of 100 maxillary impacted canines were included in the study irrespective of site. Each OPG was evaluated for vertical angulation and the data obtained was tabulated and subjected to statistical analysis.

Results: In the present study, the female to male ratio was 2.57:1, with a slightly higher prevalence of impacted maxillary canines on left side. The results of the present study show a 100% concordance between OPG and CBCT for palatal and buccal impactions, and 91% for mid-alveolus impactions.

Conclusion: Based on the results of the present study, it may be concluded that panoramic radiographs are useful for predicting the location of impacted maxillary canines against the confirmatory radiographic modality like CBCT.

1. Introduction

Canines are the cornerstones that determine the beauty of the face. Its position in the arch is crucial for both esthetics and functional aspects.[1] There are various etiologies for maxillary canine impaction, like absence of eruption guidance from an anomalous lateral incisor, long and tortuous path of eruption, hypodontia, agenesis, aplasia and supernumerary teeth.[2] Canine impactions are also associated with conditions such as malnutrition, anemia, rickets and cleft lip and palate and certain syndromes such as cleidocranial dysplasia, Down's syndrome etc.[3]

An impacted tooth is defined as a tooth that has failed in its eruptive movement, from its development location in the alveolar process to its position in dental arch within its normal period of growth and development, and that it won't apparently full erupt based on clinical or radiographic assessment.[4] Many methods for canine localization using two dimensional dental radiographs like orthopantomogram (OPG), lateral cephalography etc. have been described in the literature, but none of those methods alone has 100% accuracy, when compared with computed tomography (CT)

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https://doi.org/10.18231/j.jds.2024.008

and cone-beam computed tomography (CBCT).[5,6] Proper treatment requires accurate diagnosis of the localization of impacted maxillary permanent canine tooth in relation to adjacent structures, assessment of root resorption and change in root morphology.[7]

OPG provides an overview of the oral cavity, and may help in assessing mesio-distal impaction of teeth, however it has limitation in assessing labio-palatal position of impacted canines, whereas, CBCT can identify and locate the position of impacted canines accurately and can also assess damage to the roots of adjacent teeth and amount of bone surrounding each tooth.[8]

Therefore, this study was conducted to determine the usefulness of OPG for correct localization of impacted maxillary canine with the aid of CBCT as a confirmatory radiographic modality.

2. Materials and Methods

2.1. Data collection

The present study group comprised of 100 impacted maxillary canines, radiographed with a digital panoramic radiograph and cone-beam computed tomography scan, using purposive sampling technique. The radiographs were collected from the archives in the department of oral medicine and radiology. Diagnostic and clinical information for each patient was retrieved including general systemic disease, ongoing medication, developmental disturbances, history of orthodontic/orthognathic treatments, facial trauma/skull surgery and dentoalveolar surgery.

2.2. Inclusion criteria

Collected data set should have the impacted canines, unilateral or bilateral with age of 18 years and above whose OPG and CBCT both were taken.

2.3. Exclusion criteria

Any patient data set with missing central incisors, developmental anomalies, gross abnormalities of dental arches, craniofacial syndromes, systemic condition affecting tooth structures of canine, cysts and tumours involving the maxillary impacted canine, history of orthodontic/orthognathic treatments, facial trauma or surgery or any other associated lesion with impacted maxillary canine was excluded from the study.

2.4. Method of evaluation

For each subject OPG and CBCT (cone-beam computed tomography) scans taken by cone-beam computed tomography machine (CBCT) machine (Carestream CS 9000, Carestream Dental, Atlanta, Ga) were retrieved in DICOM format.

Each OPG was evaluated using angulation method which involves measuring the angulation of the impacted maxillary canine with the occlusal plane. The angle formed between a horizontal line drawn from the mesiobuccal cusps of right and left maxillary first molars and another line along the long axis of the impacted maxillary canine was measured. The impacted canine is diagnosed to be buccally placed when this angle is greater than 65^o while it is diagnosed to be palatally placed when the angle is lesser than 65^o. (Figure 1)

The CBCT data volumes were reconstructed using Ez3D2009 CBCT software and the labiopalatal position of impacted canines were assessed in static cross-sectional reformatted images. (Figure 2) In assessing CBCT studies, examiner reviewed the entire volume and was allowed to reformat images. The labiopalatal position of canines was classified as labial, mid-alveolus and palatal, depending on the relative position of the canine crown to adjacent teeth.

2.5. Statistical analysis

The readings were analyzed by the statistical expert in SPSS (statistical package for social sciences) 22.0 version software. Statistical procedure was carried out in two steps, data compilation and presentation and statistical analysis. The total data was distributed meaningfully and presented as individual tables. The predicted positions of impacted canines were compared using the Student t test with p value < 0.05 was considered statistically significant.

3. Results

Table 1: Gender wise distribution of impacted maxillary canines

Male	28 (28%)
Female	72 (72%)
Total	100 (100%)

Table 2: Side wise distribution of impacted maxillary canines

Right	46 (46%)
Left	54 (54%)
Total	100 (100%)

4. Discussion

The most critical point in the prevention of possible maxillary canine impaction is early diagnosis, to predict the subsequent failure of eruption. The best time to begin assessing potential impaction is during the early mixed dentition period, because the early diagnosis of one dental anomaly may indicate an increased risk for later appearance of other.[4,9] Since CBCT is a 3-D imaging system, it can determine the actual position of impacted canine, along with its relation to its adjacent structures. However, from

Table 3: Angulation ofimpacted maxillary canines

	OPG (n=100)		CBCT (n=100)		Concordance w.r.t CBCT	Student t test
	n	%	n	%		
Palatal	54	54%	52	52%	100%	
Mid Alveolus	10	10%	11	11%	91%	0.0001*
Buccal	36	36%	37	37%	100%	

*p-value less than 0.05 is considered statistically significant

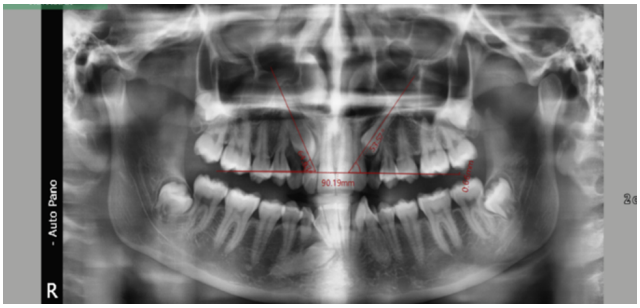

Figure 1: Analysis of OPG showing angulation of impacted maxillary canine of right and left side. Angle is formed between the long axis of canine and occlusal plane.

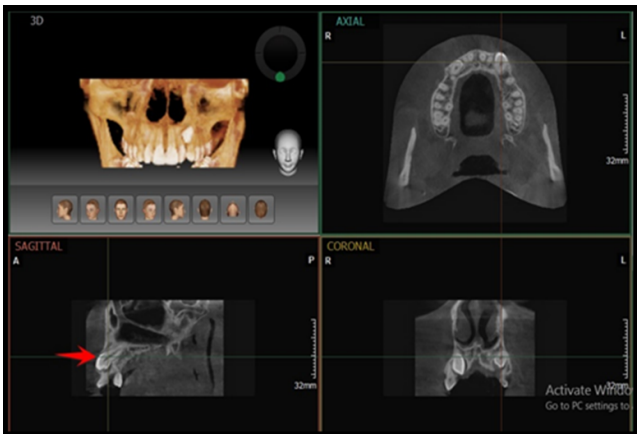

Figure 2: CBCT Showing buccally placed impacted maxillary canines in cross-sectional reformatted images in CBCT.

the panoramic view, impaction of maxillary canine is an occasional but significant finding. It could be advantageous if this single film could be reliably used for localization of the unerupted teeth.[3,10] Also, the current UK and European guidelines have suggested using the small FOV CBCT for assessing impacted canine only in selected cases where conventional radiographs fail to provide sufficient information to construct a treatment plan. However, the British Orthodontic Society – Orthodontic Radiographs guidelines have reported that there is no indication for the routine use of CBCT to detect impacted maxillary canines as the CBCT technique is associated with a higher overall effective dose of ionizing radiation than the conventional radiography.[11]

In the present study (Table 1), the female to male ratio was 2.57:1, which is in accordance with many studies which showed that these impactions are more common in females, compared to males, with a ratio of 2:1.[1,3] However, a study conducted by Pico et al. found the number of male and female patients in a ratio of 1:1 and justified that by their reduced sample size (only 28 impacted canines in 20 patients).[4]

Based on the results of the present study, it was found that 46% of maxillary canines were impacted on the right side and 54% were impacted on the left side, stating a slightly higher prevalence on left side (Table 2). This is similar to the findings of Al Zoubi et al., who also reported a higher prevalence of impacted maxillary canines on left side, compared to the right side.[12] However, an almost equal distribution of impacted maxillary canines was found by a study conducted by El Beshlawy DM et al., with 51% canines impacted on the right side and 50% impacted on the left side. There is no scientific evidence to clarify the higher prevalence of left side.[13]

In the current study, out of 100 impacted canines on OPG, 54 (54%) were placed palatally, 10 (10%) were placed in the mid-alveolus region and 36 (36%) were placed buccally. Whereas, on CBCT, 52 (52%) were placed palatally, 11 (11%) were placed in the mid-alveolus region and 37 (37%) were placed buccally (Table 3). Our prevalence of impacted canines is similar to that reported by Katsnelson A et al, who reported that 55% of canines were impacted palatally and 45% were impacted buccally.[14] In general, 85% of patients have presented with a palatal inclination and 15% with a buccal inclination. Caprioglio et al reported a ratio of 1:3 for buccal to palatal displacement.[14]

A canine can be palatally impacted because extra space is available in the maxillary bone. This space can be provided by (1) excessive growth in the base of the maxillary bone, (2) space created by agenesis or peg-shaped lateral incisors, or (3) stimulated eruption of the lateral incisor or the first premolar. In those conditions the canine is free to "dive" in the bone and to become palatally impacted.[15]

A study conducted by Ahad M et al compared 4 methods for localization of impacted canines and concluded that in angulation method, the palatal sensitivity was 57% and buccal sensitivity was 100%, whereas for horizontal parallax method, the palatal specificity was 66% and buccal specificity was 100%. Their results showed that horizontal

parallax and angulation method are better in excluding the palatal located maxillary canine diagnosis as compared to other methods but all the methods are same to exclude the diagnosis of buccally located maxillary canine.[5] This is in accordance with the present study which shows that angulation method is 100% accurate for diagnosis of buccally and palatally impacted maxillary canine.

According to Ericson and Kurol, the absence of the "canine bulge" at earlier ages should not be considered as indicative of canine impaction. In their evaluation of 505 schoolchildren between 10 and 12 years of age, they found that 29% of the children had nonpalpable canines at 10 years, but only 5% at 11 years, whereas at later ages only 3% had nonpalpabte canines. Therefore for an accurate diagnosis the clinical examination should be supplemented with a radiographic evaluation.[16]

5. Conclusion

Delayed diagnosis of impacted canines may lead to complex and expensive surgical procedures to manage them. Moreover, these procedures may take a long duration and cause damages to adjacent teeth, like root resorption and gingival recession of adjacent teeth. Therefore, early diagnosis will help to avoid the abovementioned complications.

Based on the results of the present study, it may be concluded that panoramic radiographs are useful for predicting the location of impacted maxillary canines when compared against the confirmatory radiographic modality like CBCT. CBCT has demonstrated to be an effective and competent method for determination of position of maxillary impacted canine and has to be reserved for extremely complex and multi-quadrant impaction cases.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. Adersh GA, Kumar LKS, Kurien NM. Localisation of impacted maxillary canines using OPG; comparison of reliability of two techniques. *Int J Curr Res*;11(04):3021–6.
2. Kaur N. Evaluation of Canine Impaction with Panoramic Radiographs- An Original Research. *Int J Res Health Allied Sci*. 2016;2(4):82–4.
3. Alassiry A. Radiographic assessment of the prevalence, pattern and position of maxillary canine impaction in Najran (Saudi Arabia) population using orthopantomograms - A cross-sectional, retrospective study. *Saudi Dent J*. 2020;32(3):155–9.
4. Pico C, Vale FJF, Caramelo F, Corte-Real A, Pereira SMA. Comparative analysis of impacted upper canines: Panoramic radiograph Vs Cone Beam Computed Tomography. *J Clin Exp Dent*. 2017;9(10):1176–82.
5. Ahad M, Imran M, Khan A, Ahmad M, Yaqoob N, Nazir S, et al. Evaluation of different radiographic methods for the localization of impacted maxillary canine -a comparative study. *Int J Contemp Med Res*. 2016;3(9):2589–92.
6. Dinu S, Todor L, Zetu IN, Pacurar M, Porumb A, Milutinovici RA, et al. Radiographic methods for locating impacted maxillary canines. *Rom J Morphol Embryol*. 2022;63(4):599–606.
7. Bokkasam VK, Devaki SB, Jayam RR, Muddepalle P, Marisetty C, Tupalli AR, et al. Reliability of single panoramic radiograph with vertical and horizontal parallax; and intraoral periapical radiograph with Clark's rule compared to computed tomography/surgical exposure in localization of impacted permanent maxillary canine. *J Indian Acad Oral Med Radiol*. 2015;27(4):527. doi:10.4103/0972-1363.188725.
8. Jung YH, Liang H, Benson BW, Flint DJ, Cho BH. The assessment of impacted maxillary canine position with panoramic radiography and cone beam CT. *Dentomaxillofac Radiol*. 2012;41(5):356–60.
9. Kumar S, Mehrotra P, Bhagchandani J, Singh A, Garg A, Kumar S, et al. Localization of impacted canines: A review. *JCDR*. 2015;9(1):11–4.
10. Bhuvaneshwari, Ahmed J, Singh M. Use of Panoramic Radiograph as a Single Radiographic Technique to Localize Impacted Maxillary Canine. *J Cancer Sci Ther*. 2010;2(6):163–5.
11. Al-Turaihi BA, Ali IH, Alhamadani GM, Alam MK. Patterns of Maxillary Canine Impaction in Iraqi Population. *Assoc Supp Oral Health Res*. 2020;20:e5266. doi:10.1590/pboci.2020.120.
12. Al-Zoubi H, Alharbi AA, Ferguson DJ, Zafar MS. Frequency of impacted teeth and categorization of impacted canines: A retrospective radiographic study using orthopantomograms. *Eur J Dent*. 2017;11(1):117–21.
13. Beshlawy DE, Ahmed DF. Radiographic assessment of impacted maxillary canine position using CBCT: A comparative study of 2 methods. *Egypt Dent J*. 2019;65(4):3393–402.
14. Katsnelson A, Flick WG, Susarla S, Tartakovsky JV, Miloro M. Use of panoramic x-ray to determine position of impacted maxillary canines. *J Oral Maxillofac Surg*. 2010;68(5):996–1000.
15. Jacoby H. The etiology of maxillary canine impactions. *Am J Orthod*. 1983;84(2):125–32.
16. Ericson S, Kurol J. Longitudinal study and analysis of clinical supervision of maxillary canine eruption. *Community Dent Oral Epidemiol*. 1986;14(3):172–6.

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Cite this article: Shah D, Parikh S, Shah SP, Verma O, Shah S, Patel P. Determination of the position of impacted maxillary canine – A panoramic radiographic study. *J Dent Spec* 2024;12(1):36-39.