

Comparative assessment of impacted maxillary canines- OPG and CBCT study

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Citation This Article: Jeremiah Schmid, “Comparative assessment of impacted maxillary canines- OPG and CBCT study”, IJHDC – September – October - 2022, Vol. – 1, Issue - 1, P. No. 31 – 35.

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Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Aim: The aim of this study is to correlate the position of impacted maxillary canines on Orthopantomogram (OPG) to its position on Cone beam computerized tomography (CBCT) in the study subjects.

Materials and method: A sample of 60 subjects in the age group of 13-25 years with unilateral/bilateral impacted canines was selected. Position of the impacted canines were correlated between Orthopantomogram (OPG) and cone beam computed tomography (CBCT) images using sector location, angular, linear parameters and root resorption of the lateral incisor adjacent to the impacted canine was assessed.

Results: Significant positive correlation was found between the linear parameters, sector location between the panoramic radiographs and CBCT images.

Conclusion: Sector location of maxillary impacted canines on panoramic radiographs can be used alternatively for locating impacted maxillary canines.

Keywords: Cone beam computed tomography, impacted canine, Orthopantomogram.

Introduction

Maxillary canines play a vital role in establishing an esthetic facial contour, pleasing smile line, and canine guided occlusion. It is the second most common tooth to get impacted after the third molar. Untreated impacted canines can result in complications such as shortening of the dental arch, follicular cyst formation, canine ankylosis, recurrent infections, pain, internal resorption, and external resorption of the canine and adjacent teeth. Routinely, the first choice of imaging modality is the conventional radiography (Panoramic radiographs) when an impacted canine is suspected. However, with the advent of CBCT, it is possible to precisely position the impacted canines, determine the amount of bone covering it and evaluate the condition of adjacent anatomic structures. This study was conducted to correlate the position of impacted canines on OPG and

CBCT to know the reliability of the diagnostic information provided by panoramic radiographs and possibly reduce the need for CBCT images.

Materials and method

The present study was carried out in the Department of Orthodontics and Dentofacial Orthopaedics. It was approved by the Institutional ethical committee. For this study, 60 subjects with age ranging from 13-25 years visiting the department of Orthodontics with clinically unerupted maxillary canines were chosen.

Inclusion criteria

- Age group of the selected subjects in the range of 13-25 years
- Unilateral or bilateral maxillary impacted canines
- No history of previous orthodontic treatment.

Exclusion criteria

- Individuals with craniofacial syndromes
- Any history of dental and facial trauma.
- Presence of odontogenic cysts and tumours around the impacted canine

Selection criteria

Digital panoramic radiographs were taken using Planmeca Scara-3 and the exposure parameters were set at 80 KVp, 320 mA and 0.37 s. The sector classification of the impacted canine cusp tip and root tip was done according to classification given by Alessandri Bonnetti (2009) and McSherry et al (1992)

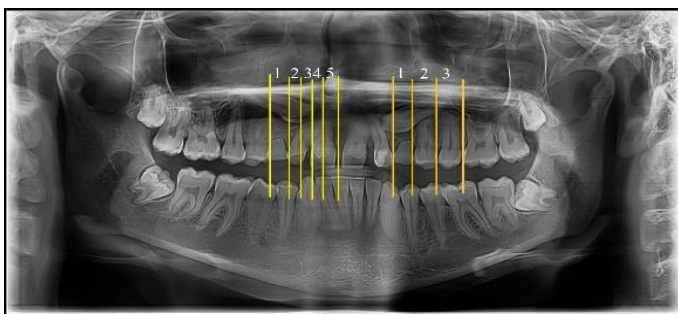


Figure 1: Sector classification of impacted canine crown tip

Sector 1: Corresponds to the deciduous canine.

Sector 2: Indicates the distal aspect of the lateral incisor to the midline of the lateral incisor.

Sector 3: Indicates the midline of the lateral incisor to the distal aspect of the central incisor.

Sector 4: Indicates the distal aspect of the central incisor to the midline of the central incisor.

Sector 5: Indicates the midline of the central incisor to the midline of the maxillary arch.

Sector classification of impacted canine root tip

Sector 1: root apex above the position of the canine

Sector 2: root apex above the first premolar

Sector 3: root apex above the second premolar

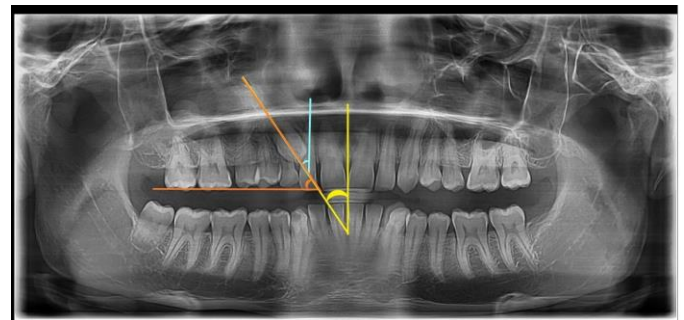


Figure 2: Alpha, beta and gamma angles, vertical distance d1 and horizontal distance d2 on OPG

Alpha angle: The angle formed by the midline of the maxillary arch and long axis of the canine.

Beta angle: The angle formed by the long axis of the impacted canine and the long axis of the lateral incisor.

Gamma angle: The angle formed by the long axis of the impacted canine to the occlusal plane.

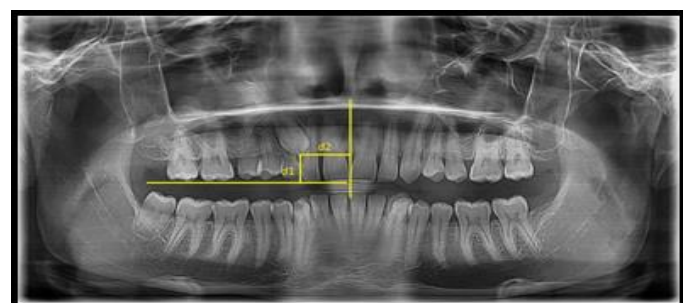


Figure 3: Alpha, beta and gamma angles measured in CBCT

d1: The distance measured from the cusp tip of the impacted canine to the occlusal plane.

d2: The distance measured from the cusp tip of the impacted canine to the occlusal plane.

The sector location, angular and linear parameters were measured on the OPG using the Ez-Denti Software.

On CBCT, the following parameters were measured.

α-angle: The angle formed by the midline of the maxillary arch and long axis of the canine in the coronal view.

β-angle: The angle formed by the long axis of the impacted canine and the long axis of the lateral incisor in the sagittal view

γ-angle: The angle formed by the long axis of the impacted canine to the occlusal plane in the coronal view.

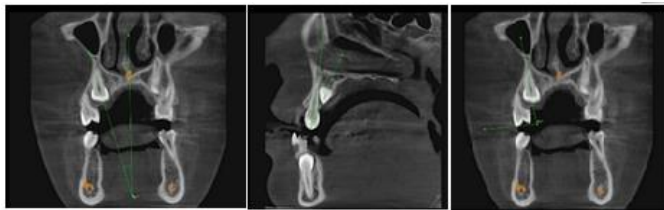


Figure 4: d1 and d2 measured in CBCT

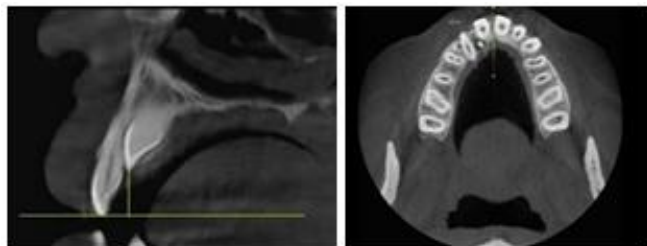


Figure 5: Sector classification done in axial view in CBCT using Alessandri's classification

Results

The Normality tests, Kolmogorov-Smirnov and Shapiro-Wilks tests results reveal the study followed normal distribution. To analyse the data, parametric test is applied. Unpaired t-test was done to assess and compare the mean values and Pearson correlation analysis was done to assess the association between the variables in

the study. To analyse the data, SPSS (IBM SPSS Statistics for Windows, Version 26.0, Armonk, NY: IBM Corp. Released 2019) software is used. Significance level is fixed as 5% ($\alpha = 0.05$).

Table 1: Distribution of impacted maxillary canines based on labiopalatal position

Position of canine	Female	Male	Total	p-value
Labial	16	11	27	0.53
Mid-alveolus	4	6	10	
Palatal	23	14	37	
Total	43	31	74	

Table 1 shows that from 74 impacted maxillary canines, 27 were labially impacted (36.4%), 10 were mid-alveolus impacted (13.6%) and 37 were palatally impacted (50%). This finding is in accordance with Jacoby et al¹, Shapira et al², Ericson et al³, Walker et al⁴, Thilagavathy et al⁵, Schindel et al⁶, Johnston et al⁷, Quadras et al⁸, Bjerklin et al⁹ who reported majority of the impacted canines to be located palatally. The difference between labially, palatally and mid-alveolar placed canines was statistically non-significant.

Table 2: Correlation of vertical distance d1 and horizontal distance d2 of maxillary impacted canines on occlusal plane in OPG and in CBCT

Variables	Mean (mm)	Correlation(r)	P-Value
OPG-d1	13.07 ± 6.04	0.745	<0.01*
CBCT-d1	12.89 ± 5.73		
OPG-d2	8.11 ± 4.64	0.861	<0.01*
CBCT-d2	7.77 ± 4.56		

Table 2 shows that the mean value of d1 (the distance measured from the cusp tip of the impacted canine to the occlusal plane) on OPG is 13.07 mm ± 6.04 mm and on CBCT is 12.89 mm ± 5.73 mm. A strong positive correlation exists between d1 measured on OPG and

CBCT ($r=0.745$) and this correlation is statistically significant ($p<0.01$). The mean value of d2 (The distance measured from the cusp tip of the impacted canine to the occlusal plane) on OPG is $8.11 \text{ mm} \pm 4.64 \text{ mm}$ and on CBCT is $7.77 \text{ mm} \pm 4.56 \text{ mm}$. A very strong positive correlation exists when d2 is measured both on OPG and CBCT ($r=0.861$). This correlation is statistically significant ($p<0.01$) respectively indicating that not much variation is observed in linear measurement both on OPG and CBCT.

Table 3: Correlating sector location of impacted maxillary canines (OPG) to resorption of maxillary lateral incisor roots

Variables	OPG	CBCT
Mean	2.7763	2.5395
SD	1.44774	1.28001
Correlation (r)	0.958	
P-value	<0.01*	

Table 3 shows this finding is in accordance with the study conducted by Mohammed et al¹⁰ who observed statistically significant correlation ($r=0.836$, $p<0.01$) for d1 and ($r=0.835$, $p<0.01$) for d2. Statistically significant correlation was found between the sector location of the impacted canine on OPG and their labio-palatal position on CBCT.

Conclusion

Palatally impacted canines were more common (50%) followed by buccally impacted canines (36%) and mid-alveolar impacted canines (13%). Increased tendency of root resorption of lateral incisors was observed in palatally impacted canines. Therefore, CBCT is recommended in these cases for treatment planning. Increased sample size and gender discrimination would be more conclusive.

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