

ASSESSMENT OF MAXILLARY IMPACTED CANINES USING PANORAMIC RADIOGRAPH AND CONE-BEAM COMPUTED TOMOGRAPHY

Shaimaa Elmarhoumy* and Nahla Elsayed Gomaa**

ABSTRACT

Aim: Assess the labio-palatal position of maxillary impacted canines (MICs) on CBCT and their mesiodistal position on panoramic radiographs.

Materials and Methods: This retrospective radiographic study reviewed 70 radiographs with MICs (40 bilaterally and 30 unilateral). Radiographs with, odontoma, mesiodens, or cleft lip and palate were excluded. The mesiodistal position of the MICs was classified into four sectors on panoramic radiograph while their labio-palatal position were evaluated on CBCT. The correlation between panoramic sectors location and CBCT results was examined using the chi-square test.

Results: Labial positioned MICs on CBCT were more frequent in panoramic sector 1, while palatally positioned MICs were more frequent in sectors 4. The association between sectors of the MICs on panoramic images and the labio-palatal position of the MICs on CBCT was statistically significant ($P < 0.001$).

Conclusions: This study showed that, sector location on panoramic radiographs might be used for prediction of labio-palatal position of MICs.

KEY WORDS: Impaction, maxillary canine, panorama, CBCT.

INTRODUCTION

Maxillary permanent canine is considered as the second most commonly impacted tooth (the first most commonly impaction is the third molar). Impacted canine may be located palatal or buccal to dental arch or in line with the arch. Buccal and in line with arch impaction can be attributed to early loss of deciduous teeth that may lead to arch length

loss, crowding tendency, or space deficiency of dental arch. While, palatal impaction may be due to genetic cause or loss of lateral incisor guidance on its distal surface [1]. Panoramic radiograph has been used in orthodontics as a routine method to diagnose and identify canine impaction by locating cusp tip of canine in relation to root of lateral incisor, state of tooth eruption, tooth angulation,

* Lecturer of Orthodontics, Faculty of dentistry, Tanta University, Egypt.

** Assistant Professor of Orthodontics, Faculty of Dentistry, Tanta University, Egypt.

third molar prognosis, plan treatment and also to assess treatment results^[2]. Limitation of panoramic radiograph can be referred to blurring of image error of distortion projection overlapping of adjacent structures to impacted canine leading to difficulty in assessing impacted canine labiopally and incisors root resorption^[3,4]. Limitations of CT to be used to analyze impacted canine include higher exposure dose related to panoramic radiograph and it is relatively expensive^[5]. These limitations can be overcome by using cone beam computed tomography (CBCT) as it is considered the most accurate method to locate impacted canine, mesial angulation of root, root resorption and root contact.

Several studies about reliability of panoramic radiograph and CBCT on specific conditions - such as canine and third molar impaction, supernumerary teeth, and root resorption - were done. These studies revealed that CBCT gives more reliable information than panoramic radiograph in these conditions^[6,7]

The aim of our study is to assess the use of panoramic radiograph and CBCT to localize maxillary impacted canine.

MATERIALS AND METHODS

The subjects in this study were selected with impacted maxillary canine with age above 12 years (46 female and 24 male) involved 40 bilaterally impacted canine and 30 unilateral impacted canines (18 at right side and 12 at left side). The sample size and power analysis were calculated using Epi-Info software statistical package created by World Health organization and center for Disease Control and Prevention, Atlanta, Georgia, USA version 2002. The criteria used for sample size calculation were as follows: 95% confidence limit, 80% power of the study, The sample size was found at N = 70 participants. The Exclusion criteria were systemic diseases, odontoma, mesiodens, or cleft lip and

palate. For each patient, panoramic radiograph was made using a Proline XC* radiography unit and CBCT scan was acquired with a DCT Pro** Scanning parameters was 90 kVp, 24 s, 4 mA, voxel size 0.4 mm and field of view 20×19 cm. [8]. A CBCT scanner was used to identify the exact locations of the impacted maxillary canines. Using CBCT data, each sample was classified according to the labiopallatal location of the maxillary impacted canine into labial and palatal groups.

The mesiodistal positions of the impacted maxillary canines were classified into a panoramic sector using Ericson and Kurol's method [9] (fig.1). Each measurement was recorded by single examiner. To evaluate intraexaminer reliability, data were reinvestigated after an interval of 1 month. The correlation between the sector location on the panoramic radiographs and the labiopallatal position on the CBCT images was investigated using the chi-square test.

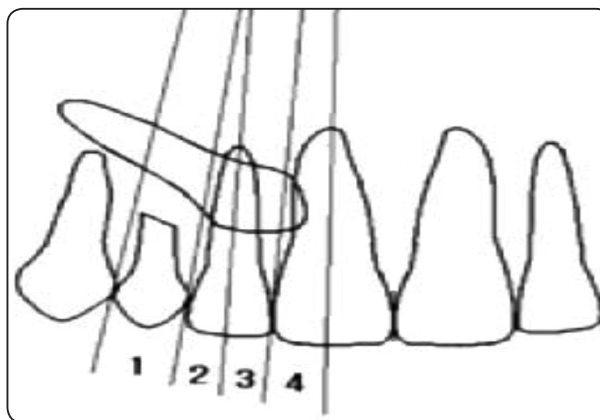


Fig. (1) Sector Locations of maxillary canine cusp tips on panoramic radiographs. Sector 1: area distal to the line tangent to the distal heights of contour of the lateral incisor crown and root. Sector 2: area bounded by sector 1 and the long axis of the lateral incisor. Sector 3: area bounded by sector 2 and a line tangent to the mesial heights of contour of the lateral incisor crown and root. Sector 4: area bounded by sector 3 and the long axis of the central incisor.

* (Planmeca, Helsinki, Finland)

** (Vatech Co., Hwasung, Republic of Korea)

RESULTS

Twenty four of 37 labially maxillary impacted canines were in sector 1, while 13 MICs were in sector 2. As regard to the palatal group, 22 were in sector 4 while 11 MICs were in sector 3. A statistically significant correlation was observed between the sectors and the labiopalatal positions of the canines ($P < 0.001$; Table I). Labially impacted maxillary canines were more frequently observed in sector 1 (fig 2), while palatally impacted maxillary canines were more frequently observed in sector 4 (fig 3).

TABLE (I) Relationship between sector location on panoramic radiographs and labiopalatal position on CBCT images.

Impaction position	Sectors				Total	Chi-square	P value
	1	2	3	4			
Labial	24	13	0	0	37	29.001	0.001*
Palatal	0	0	11	22	33		
Total	24	13	11	22	70		

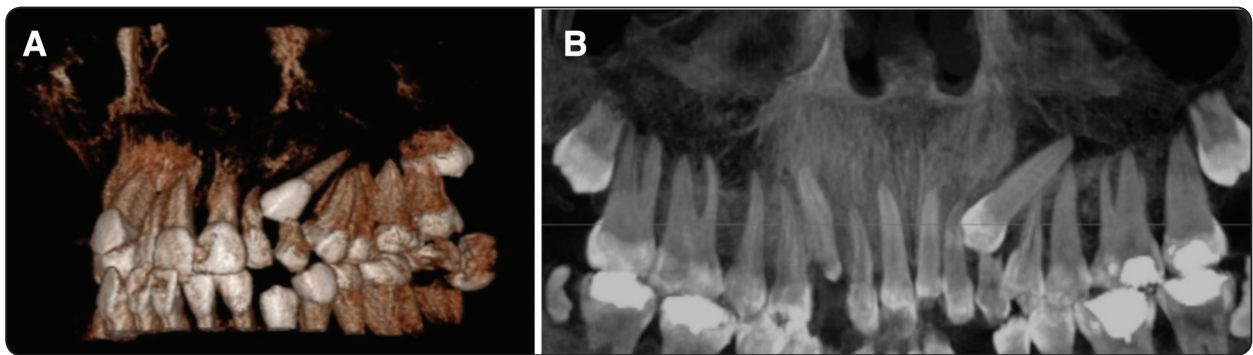


Fig. (2) (A) CBCT image showing labially impacted maxillary left canine. (B) panoramic radiographic image showing labially impacted maxillary left canine in sector 1.

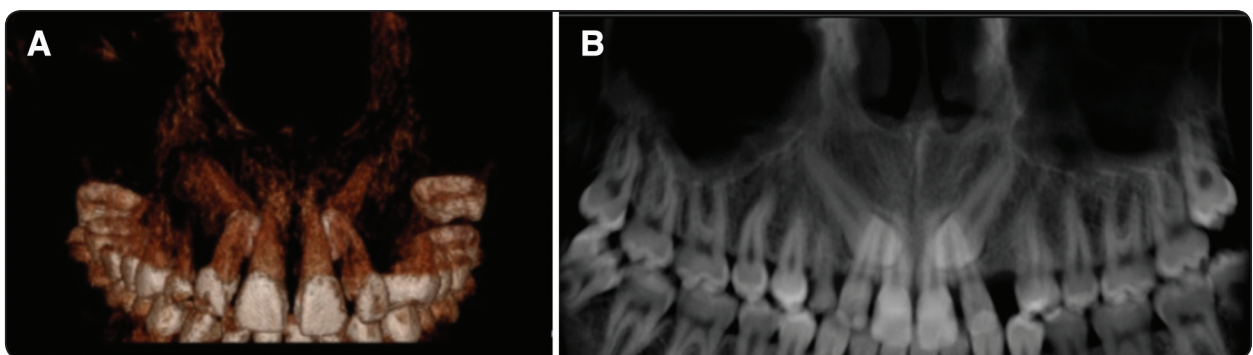


Fig. (3) (A) CBCT image showing palatally impacted maxillary canines (B) panoramic radiographic image showing palatally impacted maxillary canines in sector 4.

DISCUSSION

Buccal impaction of permanent maxillary canines can be attributed to crowding of dental arch due to arch length deficiency either due to genetic or local cause^[1]. Palatal impaction of permanent maxillary is due to lack of guidance to canine as in peg shaped, short root or missing lateral incisor^[1,4].

CBCT was used to overcome limitations panoramic and CT radiographs.

The aim of this study was to correlate between panoramic radiograph and CBCT in localization of maxillary impacted canine.

Panoramic and CBCT radiographs were used to locate mesiodistal positions of the impacted maxillary canines. Impacted canines were classified into a panoramic sector using Ericson and Kuroi's method^[9]. Results showed that statistically significant correlation between sectors and labiopalatal positions of the canines was found.

These results are in line with those done by Serrant et al in that CBCT is more accurate than 2D panoramic radiograph in localization of maxillary impacted canines^[10].

Regard sector location, Lindauer et al and Warford et al stated that sector location has a great effect on prediction of impacted canine more than angulation has. They found that labial impaction of canine using CBCT were frequent on panoramic radiograph in sector 1,2 and 3, while, palatally impacted canines were more frequent in sector 4 using panoramic radiograph. These results coincide with those found in this study^[3,11].

This study suggests that sector location using panoramic radiograph can help in determining labiopalatal position of maxillary impacted canines, to minimize using CBCT to decrease the cost for patient.

CONCLUSION

Based on the findings of the current study, the following conclusions can be suggested:

- Labially impacted maxillary canines as seen on CBCT were more frequent observed in sector 1, while palatally impacted maxillary canines were more frequent seen in sectors 4, on panoramic radiographs.
- Sector location on panoramic radiography can be used to predict the labiopalatal position of maxillary impacted canines.

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