

The multi-detector computed tomographical analysis of bone density in impacted maxillary canines

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ABSTRACT

Background: Maxillary canines are important aesthetically and functionally, but impacted canines are more difficult and time consuming to treat, the aim of this study is to investigate with multi-detector computed tomography the correlation between the bone density and the upper canine impaction.

Material and method: A sample of Unilaterally impacted maxillary canines from 24 patients (19 female, 5 male) who were referred to accurately localize the impacted canines at al- Karkh general hospital were evaluated by a volumetric 3-d images by the multi-detector computed tomography to accurately measure the bone density of the maxillary cortical palate of the maxillary impacted canine side and compare it with the other side of the normally erupted canine.

Results: The statistical descriptive analysis showed that the ratio of the maxillary canine impaction was higher in females than in males, also the it revealed that the mean bone density of the cortical bone was greater in the maxillary impacted canine side (affected side) than in the control side (the side of the normally erupted canine), the Wilcoxon signed ranks test showed a significant difference in the mean bone density between the affected side and the control side.

Conclusions: The increased bone density of the maxillary cortical plate could be an obstructive factor that cause maxillary canine impaction.

Keyword: Multidetector computed tomography, impacted maxillary canine, bone density. (J Bagh Coll Dentistry 2013; 25(3):165-167).

INTRODUCTION

Maxillary canines are important aesthetically and functionally, but impacted canines are more difficult and time consuming to treat ⁽¹⁾.

Permanent maxillary canines are the second most frequently impacted teeth; eighty-five percent of impacted maxillary permanent cuspids are palatal impactions, and 15% are labial impactions. Inadequate arch space and a vertical developmental position are often associated with buccal canine impactions. If buccally impacted cuspids erupt they do so vertically, buccally and higher in the alveolus. However due to denser palatal bone and thicker palatal mucosa, as well as a more horizontal position, palatally displaced cuspids rarely erupt without requiring complex orthodontic treatment ⁽²⁾.

Although impacted canines can be seen in tooth size arch length discrepancy, early loss of deciduous teeth, craniofacial syndromes like Crouzon syndrome, cliedocranial dysostosis etc, the exact etiology of palatally impacted maxillary cuspids is unknown; however, two common theories may explain the phenomenon: the guidance theory and the genetic theory ⁽³⁾. The "guidance theory of palatal canine displacement" proposes that this anomaly is a result of local predisposing causes including congenitally missing lateral incisors, supernumerary teeth, odontomas, transposition of teeth and other mechanical determinants that all interfere with the path of eruption of the canine.

Maxillary canines develop high in the maxilla, are among the last teeth to develop and travel a long path before they erupt into the dental arch. These factors increase the potential for mechanical disturbances resulting in displacement and, thus, impaction.

The second theory focuses on a genetic cause for impacted cuspids. Palatally impacted maxillary cuspids often present with other dental abnormalities, including tooth size, shape, number and structure, which Baccetti reported to be linked genetically ⁽⁴⁾. Research demonstrates that up to 33% of patients with palatally impacted cuspids also have congenitally missing teeth, a frequency that is 4-9 times that of the general population ⁽⁵⁾.

Diagnosis and early detection of impacted maxillary canines may reduce treatment time, complexity, complications and cost. Recently, computed tomographic scanning (CT) has been used, because it can provide more reliable information than conventional methods ⁽⁶⁾. CT provides excellent tissue contrast, eliminating blurring, overlapping of adjacent teeth, distortion and projection effects are also encountered with conventional radiographs ⁽⁷⁾.

The aim of this study was to investigate with computed tomography the bone density of the maxillary cortical plate for patients with maxillary impacted canine and compare it with the other normally erupted canine side to see if there is any correlation between the bone density and the maxillary canine impaction.

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MATERIALS AND METHODS

CT images were collected from 24 consecutive patients (19 female, 5 male) with unilaterally maxillary impacted canine who were referred to Al-Karkh General Hospital /the Computerized Tomography department for localization of impacted maxillary canines. The patients' ages ranged from 16 to 20 years (average=18), they were selected after meeting a special criteria (no history of general diseases that affect the bone density such as hypertension, chronic renal failure, diabetes mellitus and hormonal disorders, particularly thyroid, parathyroid, and adrenal impairment, no history of dentofacial deformities, pathologic lesions in the jaws or facial trauma).

For every subject in the sample; a clinical examination was done prior to imaging, and then the patient was informed about the investigation and instructed not to move or swallow during scanning. The patients were in supine position with the cervical spine slightly overextended backward. The head was strapped to the head rest and positioned as symmetrically as possible then the computerized tomographic imaging was taken in the Computerized tomography using Multi-slice spiral computed tomography scanner (Brilliance™ 64, Philips CT, Netherland).

The exposure protocol was 30 mA, 80 kV, 0.6 mm slice thickness, 246 mm field of view (FOV), 512x256 matrix then all images were prospectively reconstructed at 0.6 mm, using high-resolution bone filter (80 s sharp). The reconstructed transverse images (DICOMs) were transferred to the workstation, and multi-planar reconstructions were generated using the included standard dental software package. To measure the bone density of the alveolar cortical bone the transaxial reconstruction plane was selected (radial vertical images perpendicular to the occlusal plane) then the cortical bone density of interest was chosen and localized precisely about 3 to 6 mm apically from the alveolar crest as shown in figure (1) and measured on both the right and left sides in Hounsfield units (HU) by using the specific bone density evaluation tools provided in the Philips analysis software.

RESULTS

The statistical analysis showed that the ratio of the female maxillary impacted canines was higher than the male ratio of maxillary canines' impaction as seen in table 1.

Regarding the cortical bone density the descriptive analysis revealed that the bone density mean value for the affected side (side of canine impaction) was higher than the bone density mean

value of the control side (normally erupted canine side) as shown in table 2.

The inferential analysis including the Wilcoxon signed ranks test that showed significant difference between both the affected side (side of canine impaction) and the control side with respect to the maxillary cortical bone density.

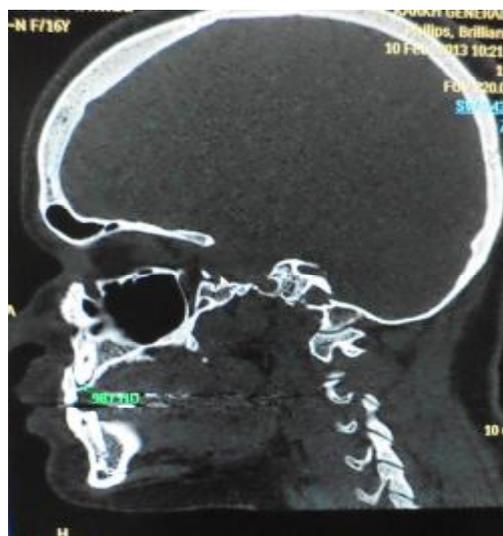


Figure 1. Measuring the bone density

Table 1. Distribution of maxillary canines according to sex

Gender	No	(%)
Males	5	(20 %)
Females	19	(80 %)
Total	24	

Table 2. The statistical analysis of the bone density

Groups	Descriptive Statistics			Group Difference	
	Median	Mean	S.D.	Wilcoxon Signed Ranks Test	P-value
Study	1197.5	1102.25	333.64	-2.54	0.011
Control	925.5	954.5	325.20		

DISCUSSION

The results of the present study showed that the prevalence of maxillary canine impaction were higher in female than male this result supports the same results with many previous researches which indicates that women are twice as likely as men to have impacted maxillary canines⁽⁸⁾.

The etiology of impacted maxillary canines is thought to be multifactorial, but the exact etiology is still unclear^(9,10). Many studies were done previously trying to find the exact cause of maxillary canine impaction some of them relate the impaction to local obstructive causes other

studies relate the impaction to systematic disorder, in this research we are attempting to find if there is any correlation between the canine impaction and the bone density, and the result of this study showed a marked increase in the mean bone density in the side of the canine impaction, also the inferential test showed a significant difference in the bone density between the normally erupted canine side and the other impacted canine side of the same patient which indicates that the bone density could be a cause for palatal canine impaction.

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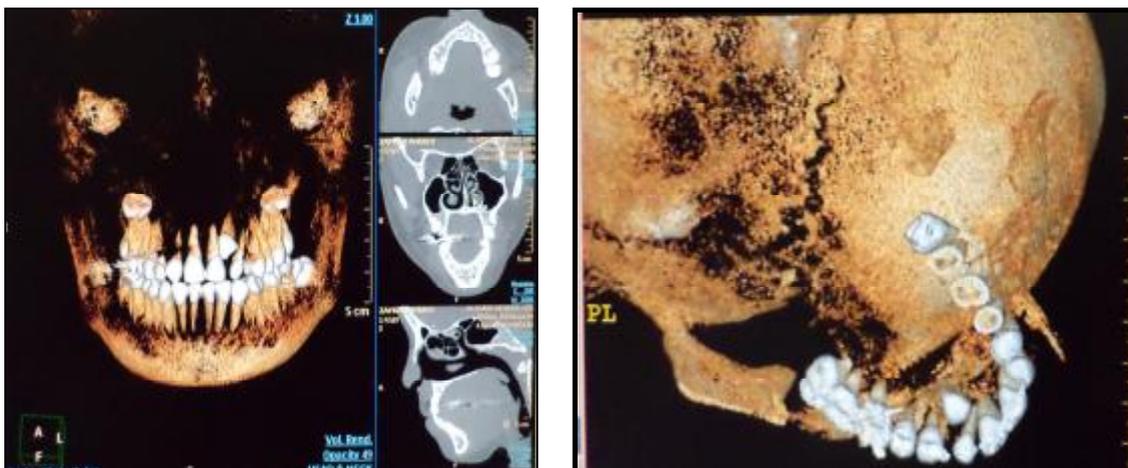


Figure 2. A 16 years old patient with impacted maxillary canine