CBCT analysis of impacted maxillary canines

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ABSTRACT

Background: This study designed to shade light on the important role of CBCT in accurate localization of the impacted maxillary canines.

Materials and method: Fifty two unilateral and bilateral impacted maxillary canines from 30 patients (24 females and 6 males) were evaluated by a volumetric 3D images obtained from cone beam CT. All samples attended to the specialist health center of dentistry in Al-Sadder City referred to CBCT by oral surgeons or orthodontists to detect the exact position of impacted upper canine in cases when there was no bulging buccally or palatally which aids to detect the exact position.

Results: Mesio-palatal angulations had the highest rate (63.5%) followed by mesio-labial (19.2%), vertical (labial) (9.6%), disto-palatal (5.8%) and disto-labial (1.9%). The relation between impacted canine and the adjacent teeth regarding to the attachment was significant only with lateral incisor. No cases of root resorption of the adjacent teeth were recorded. Bilateral impacted teeth were found in 22 patients which is highly significant (especially in females), while unilateral impaction was found only in 8 patients especially in females. Impacted canine was more prominent in female whether unilateral or bilateral.

Conclusions: CBCT imaging of impacted canines can show the following: presence or absence of the canine, angulations of the long axis of the tooth, relative labial and palatal positions and proximity to adjacent teeth. In short, CBCT imaging is clearly advantageous in imaging and management of impacted canines.

Key words: CBCT, impacted maxillary canine. (J Bagh Coll Dentistry 2013; 25(2):114-118).

INTRODUCTION

Orthodontic treatment of impacted maxillary canine remains a challenge to today's clinicians. The treatment of this clinical entity usually involves surgical exposure of the impacted tooth, followed by orthodontic traction to guide and align it into the dental arch. Bone loss, root resorption and gingival recession around the treated teeth are some of the most common complications [(1)]. Early diagnosis and intervention could save the time, expense and more complex treatment in the permanent dentition.

Tooth impaction can be defined as the infraosseous position of the tooth after the expected time of eruption, whereas the anomalous infraosseous position of the canine before the expected time of eruption can be defined as a displacement. Most of the time, palatal displacement of the maxillary canine results in impaction [(2)].

Accurate diagnostic imaging is an essential requirement to derive the correct diagnosis and optimal treatment plan, as well as monitor and document the treatment progress and final outcome [(3)].

Two-dimensional (2D) diagnostic imaging, including traditional radiographs, cephalometric tracings, photographs and video imaging, has been a part of the orthodontic patient record for decades. The limitations in analysis of these imaging modalities are well known, and include magnification, geometric distortion, superimposition of structures, projective displacements (which may elongate or foreshorten an object's perceived dimensions), rotational errors and linear projective transformation [(4,5)], in contrast, three-dimensional (3D) imaging allows for the evaluation and analysis of "the anatomical truth [(6,7)].

More recently, this high-resolution imaging technique has gained importance in diagnosing dental-associated diseases of the mandible and maxilla. CBCT (3D) offers super visualization of impacted teeth and can help the clinician to plan his treatment preoperatively or prior to orthodontic therapy (Figure 1) [(8-10)].

Dental CT investigations can be performed either on CBCT (cone beam computed tomography) or multi-detector spiral CT scanner. The device should be capable of performing high-resolution scans with a small focal spot and acquiring thin slices of 1.5 mm or less. The position of the tooth within the alveolar crest as well as the relation to surrounding structures is clearly disclosed.

Impacted and transposed teeth are possibly the most common reason for use of dental CT imaging in orthodontics. The information derived can enhance the ability to localize impacted teeth, identify pathological conditions and root resorption, help plan surgical access and bond placement, and define the optimal and most efficient path for extrusion into the oral cavity that avoids or minimizes collateral damage [(2)].

Furthermore, CBCT scans can provide diagnostic information on roots of the adjacent teeth that are in close proximity to the impacted tooth or in its traction path that can be moved proactively and avoid causing damage. Another advantage of dental CT over routine radiographs

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includes the accurate measurement of the impacted tooth to aid in determining and developing the space needed for the tooth.

This study designed to shade light on the important role of CBCT in accurate localization of the impacted maxillary canines.

SUBJECTS, MATERIALS AND METHOD

The study sample comprised 30 patients with (52) impacted maxillary canines, (24 females) with 44 impacted canines and (6 males) with 8 impacted canines, with an age ranged from 10 to 20 year and the age distribution in relation to the gender clear in table (1). These patients were referred to Specialist center of Al-Sadder City for localization of these impacted canines, using Kodak 9500 CBCT. The investigation performed with 90 kV, 10 mA, 1mm slice thickness and 10.8 seconds time of exposure. The images were collected from the workstation of the CT unit.

Before investigation every patient asked about name and age then asked the patient to remove any metal object, to avoid distortion, and not to move or breathe while exposure performed. The plane for primary reconstruction is aligned parallel to the occlusal plane. The reconstruction volume ranges within many axials for inspection of the relationship between the impacted canines and peripheral bony and dental structures. Imaging data were analyzed with the software provided by the manufacturer.

The following records were evaluated in the CT workstation for every subject: (1) The three dimensional variations of impaction—in each case, the vertical inclination was considered first, followed by the mesio-distal migration and bucco-palatal crown location (2) Contact of impacted canine to the adjacent incisor.

After that, on the work station, each case diagnosed with 3D volumetric image (as shown in fig 2) to diagnose the impacted canine from all directions, in addition to this volumetric images, all of the samples diagnosed with multiple axial slices to show its exact direction and its relation to labial or palatal alveolar bone, (as shown in Figure 2-a) and diagnosed with sagittal slice to show its position laterally and assess the amount of bone that covered the impacted tooth labially and palatally and its relation with adjacent structure (as shown in Figure 2-b,c). Coronal slice also used to detect canine position antero-posteriorly as shown in Figure 2-d).

RESULTS

Regarding the site of impacted canine, it was found that the ratio of bilateral impacted upper canine was (84.7%), (which is highly significant) than the ratio of unilateral impacted upper canine (15.3%) (which is non-significant), as shown in table 2. As clear in the same table the female ratio is higher in bilateral (77%) than unilateral (7.7%) and the ratio of impacted upper canine in females was higher than males.

As shown in table 3, according to the direction of impacted upper canine, the percentage of palatal direction was (69.3%) higher than the percentage of labial direction (30.7%).

According to the canine angulation, the mesio-palatal angulations was higher among the others (63.5%), as clear in this table only this angulation was significant, followed by mesio-labially (19.2%), vertico-labial (9.6%), disto-palatally (5.8%) and the lowest percentage was disto-labially (1.9%).

According to the relation of impacted canine with the adjacent teeth, it was found that the highest rate of attachment with impacted canine was the lateral incisor (88.46%) which was significant.

DISCUSSION

Peck et al. [13] stated that the etiology of palatally impacted canines is genetic in origin, while the etiology of labially impacted canines is due to an inadequate arch space.[11-13].

In this study, it was found that, bilateral impacted canine more frequent than unilateral and this may be related to genetic factor and this result come in accordance with many studies [11,12,15-17]. Female ratio of impacted canine was higher than male generally and in bilateral impaction especially, this result comes in agreement with other studies [13,14].

In the current study, impaction was summarized into 4 variations, with an aim of convenient description of the complex locations of impacted canines. Mesio-palatal impacted canines were the most common representing (63.5%) of the study sample, followed by mesio-labialy (19.2%), vertico-labialy (9.6%), disto-paltaly (5.8%), and disto-labialy (1.9%) respectively, while there is no vertico-palataly case in this study. From these results, it could be concluded that, the palatal direction more than buccal direction and this come in confirm with many studies [14-17] who stated that the palatal direction of impacted upper canine is twice or more than labial direction while disagree with Peck et al. [13], who stated that, in Asian the

impacted canine usually labial, and this may be due to different race and sample size.

Relation between the impacted canine & the adjacent teeth is very important point because this impacted canine may cause resorption to the adjacent teeth when its direction or angulations very near or overlap these adjacent teeth. However in the present study there was no resorption in the adjacent teeth but there was touch them (resorption of palatal or labial bone), the most teeth that touched with impacted canine were central and lateral incisors when its angulations mesially and vertically (palatally or labial direction) and 1st and 2nd premolars when its angulations distally (palatal or labial direction).

In this study only lateral incisor was significantly touched with impacted canine (without resorption of its root) and this may be regarding to its pathway of eruption, although the remaining teeth touched to the impacted canine but it's not significantly as with lateral incisor.

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Table 1: Distribution of maxillary canines according to sex and age in a sample of 30 patients

Genders	No. of patient	Age	
		Range	Mean ± SD
Females	24	10-15	12.5 ± 2.53
Males	6	15-20	17.01 ± 2.73
Total	30	10-20	13.3 ± 3.06

Table 2: Distribution of impacted canine according to the side involvement in relation to the gender

Genders	Bilateral		Unilateral		Total
	No. of patients	No. of impacted canine	No. of patients	No. of impacted canine	
Females	20	40 (77%)	4	4 (7.7%)	44 (84.7%)
Males	2	4 (7.7%)	4	4 (7.7%)	8 (15.3%)
Total	22	44 (84.7%)	8	8 (15.3%)	52 (100%)
P-value		0.005 P<0.05 S		0.368 P>0.05 NS	

Table 3: Statistical distribution of impacted canine according direction and angulations of 52 impacted teeth

	Palataly		labially			Total	P value
No. of cases	**Mesio-palatally**	**Disto-palatally**	**Mesio-labially**	**Disto- labially**	**Vertical-labially**		
Females	30 (68.2%)	3(6.85%)	8 (18.2%)	1 (2.3%)	2(4.5%)	44(100%)	0.022 S
Males	3 (37.5%)	0(0%)	2 (25%)	0 (0%)	3(37.5%)	8(100%)	0.028 S
Total	33 (63.5%)	3(5.8%)	10 (19.2%)	1 (1.9%)	5(9.6%)	52(100%)	0.024 S
	33 (69.3%)		16 (30.7%)				
P value	0.0137 Sig.	-------	0.13 Ns.	------	0.137 Ns.	0.016 S	Signi ficant

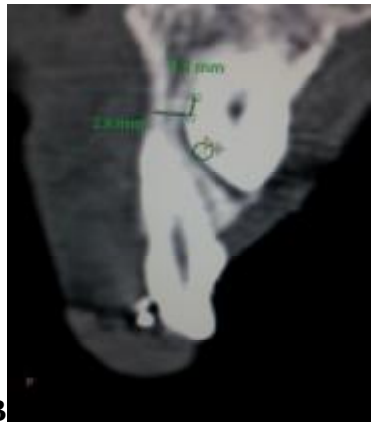
Table 4: Contact relationship between impacted canine and adjacent teeth

	Central incisor		Lateral incisor		1st premolar		2nd premolar	
Type of contact	**No touch**	**Touch**	**No touch**	**touch**	**Touch**	**No touch**	**Touch**	**No touch**
Mesio-palataly	9	24	-	33	-	-	-	-
Mesio-labialy	7	3	-	10	-	-	-	-
Disto -palataly	-	-	2	1		-	-	-
Disto-labialy	-	-	-	-	1	-	-	-
Vertico-labialy	-	-	3	2	-	-	-	-
Total	16 (30.76%)	27 (51.92%)	5 (9.61%)	46 (88.46%)	1 (1.92%)	--	-	-
P value	0.285 NS	0.283 NS	0.288 NS	0.038 S	0.157 NS	–	–	–

Figure 1: 3D volumetric image clear bilateral labial directed upper impacted canine in the right and left side for the same patient.

A 

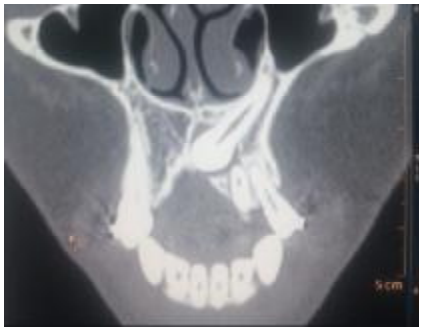
Axial

B 

Sagittal

C 

Sagittal

D 

Coronal

Figure 2: Multidetcter slices clear impacted upper canine