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EVALUATION OF PALATAL DEPTH AND NASAL SEPTUM IN PATIENTS WITH UNILATERALLY IMPACTED MAXILLARY CANINES: A CONE BEAM TOMOGRAPHY STUDY

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ABSTRACT

Objective: The present study aimed to evaluate nasal septal deviation and palatal vault depth in subjects with unilaterally buccally and palatally impacted canine using cone beam computed tomography (CBCT). **Subjects and Methods:** CBCT scans of 60 subjects were divided into 3 groups of 20 each, control group (no impaction), labial group (group with unilaterally labially maxillary impacted canine) and palatal group (group with unilaterally palatally maxillary impacted canine). Palatal depth and nasal septum deviation were measured and compared among the studied groups. **Results:** Deviated nasal septum was found in 10% of control group, 60% in palatally impacted maxillary canine group and the highest ratio (80%) was found in labially impacted maxillary canine group. Nasal septum deviation was significantly greater in the impaction groups compared with the control group, but there was no significant difference between labially and palatally impacted groups. **Conclusion:** maxillary canine impaction can be expected when nasal septum is deviated

KEYWORDS: Palatal depth, Nasal septum deviation, Impacted maxillary canines, CBCT

INTRODUCTION

The nasal septum has an essential functional aesthetic role in the nasal structure[(1)]. It consists of bones, cartilage and fibrous tissue. Nasal septum deviation is a displacement of bone or cartilage of the septum or both toward right or left side of the nasal cavity [(2)].

Deviated nasal septum may occur due to trauma, pressure during the intra uterine life that leads to disharmonic growth of the adjacent structure or due to genetic factor[(3,4)].

Although it is not a serious problem, it is one of the most common reasons for nasal congestion that lead to nasal obstruction [(5)]. One of the most deleterious effects of nasal obstruction is mouth breathing which can affect craniofacial growth [(6)].

Several malocclusions caused by mouth breathing such as, increase in the total anterior facial height, increased overjet, deep palatal vault, posterior cross bite and constriction of the upper arch, [(7-9)].

Transverse maxillary constriction may lead to impaction of maxillary canine, as the canine tooth is the last tooth erupts mesial to the molar area in the upper arch and moves about 22 mm from deepest area of the maxilla till erupts in the oral cavity [(10)].

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Most maxillary canine impactions deviate from the normal eruptive path in either buccal or palatal direction. Most of palatal impactions have enough space for eruption in contrast to buccal impactions that have not enough space for eruption. Crowding was discovered only in a few patients with palatal canine impaction [11-13].

Radiographic images are necessary to accurately locate the impacted tooth and its effect on nearby structures such as dental arch width, and alveolar bone height [14]. However, superimposition of adjacent structures makes it difficult to assess these variables using conventional radiographs [15].

The introduction of cone beam computerized tomography (CBCT) in dento-maxillofacial radiology two decades ago has resulted in a paradigm shift from planar, two-dimensional (2D) to volumetric, three dimensional (3D) radiographic visualization[16].

CBCT imaging permits orthodontists to accurately locate the impacted tooth, assess palatal bone thickness, calculate the palatal vault depth and evaluate skeletal growth pattern, airway volume and deviation of nasal septum, with low cost and exposure radiation dose. Furthermore, it overcomes superimposition of nearby structures, distortion and magnification of image that has been found in panoramic radiographs [17,18].

There is a lack of research that evaluate the relation between deviated nasal septum and impacted maxillary canine. So, the present study was conducted to evaluate nasal septal deviation and the depth of palatal vault in patients with unilaterally buccally and palatally impacted canine using CBCT.

SUBJECTS AND METHODS

The present retrospective CBCT study examined a total of 100 CBCT of Egyptian orthodontic patient from the archive of orthodontic department, Faculty of Dentistry, Tanta University and private radiology centers.

The estimated sample size was made at assumption of 95% confidence level and 84% power of study. The following equation was utilized for calculation of the sample size:

$$N= \frac{(Z_\alpha)^2 * (SD)^2}{(d)^2}$$

N= Required sample size

Z_α= Is standard normal variate and its equal 18.5

SD= Standard deviation of variable

d= Absolute error or precision

Z_α	*SD*	*d*
18.5	0.83	2

$$\text{Total sample size } n = \frac{(18.5)^2 * (0.83)^2}{(2)^2} = 58.9 \approx 60 \text{ samples}$$

Patients with asymmetric face, cleft lip and palate, craniofacial syndromes, history of previous orthodontic treatment or orthognathic surgery were excluded.

This research was approved by ethical committee (code #R-ORTH-11-22-3) of Faculty of Dentistry, Tanta University.

Sixty CBCT scans were exported and assigned for further analysis. They were divided into 3 groups of 20 each, Control group (none impaction group), Labial group (Group with unilaterally labially maxillary impacted canine) and palatal group (Group with unilaterally palatally maxillary impacted canine).

All CBCT scans were obtained using iCAT FLX 17 CBCT machine (Imaging Science International ISI, Philadelphia, USA), the field of view (FOV) was different according to the chief complains of the patients with the smallest FOV of 16 cm diameter X 6 cm height and the largest FOV of 16 cm diameter X 10 cm height. The exposure protocol for all scans used fixed 90 KVp and variable mA from 7-12 mA.

Data Collection and Analysis:

All the selected CBCT scans are exported from iCAT vision patient managing system in digital imaging and communications in medicine (DICOM) format. DICOM files were imported into Ondemand 3D App software (Cybermed, Seoul, Republic of Korea). All exported data are examined carefully after proper reorientation of the volume to record the maxillary impacted canine position (labially or palatally impacted) and side (right or left). Coronal cuts were used to measure linear variables that include the deviated septal length (DSL) measured from the maximum convexity of the deviated nasal septum to the mid-sagittal plan (Fig. 1) and the palatal depth (PD) which is the length of the line drawn perpendicularly form the midpoint of the line joining the mesiopalatal cusps of the first molars to the hard palate (Fig. 2).

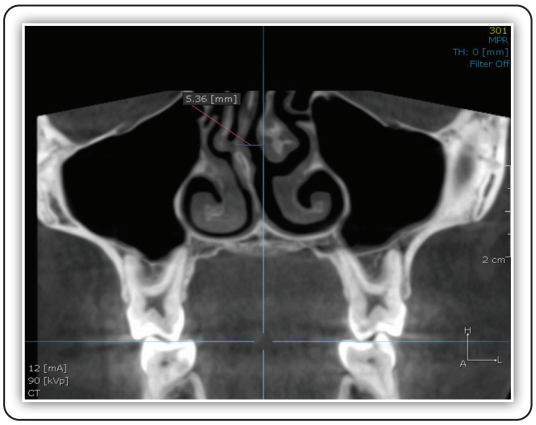

FIG (1) Showing Deviated Septal length (DSL)

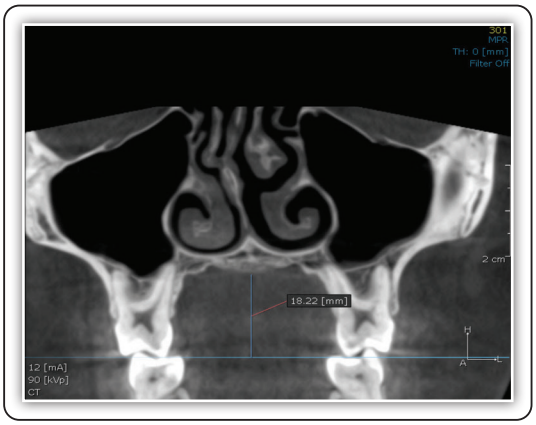

FIG (2) Showing Palatal Depth (PD)

All CBCT were reexamined 2 weeks later. Interclass correlations coefficient (ICC) was used to test the reliability of the measurements with a 95% Confidence interval. ICC for the measurement was > 0.99 which denoted a high degree of reliability.

Statistical analysis

The data were collected, and statistically analyzed using SPSS version 22 (SPSS Inc, Chicago, 1L, USA). The mean of deviated septal length and palatal depth between non-impacted and impacted groups were compared using t-test the significance level 0.05 was considered for all data analysis.

RESULTS

Measurements of palatal depth of all patients in the three groups are given in table 1. There was no statistically significant difference between control group and impaction groups or between labially and palatally impacted canine groups.

Table (1) Comparison of palatal depth (PD) between control, labial and palatal impaction groups.

PD	Control	Labial	Palatal
Range	18.01–23.17	18.22–21.79	17.89 – 21.79
Mean±SD	20.49±1.40	19.94±1.39	19.77±1.22
F. test		1.567	
P. value		0.218	
Control & Labial	**Control & Palatal**		**Labial & Palatal**
0.196	0.097		0.706

Among the 60 CBCT images reviewed, deviated nasal septum was found in 10% of control group, 60% in palatally impacted maxillary canine group and the highest ratio (80%) in labially impacted maxillary canine group (table 2).

Regarding deviated septal length, there was statistically significant greater deviation of the nasal septum in the impaction groups more than in

the non-impaction group. However, there was no statistically significant difference between the two impacted groups (labial and palatal groups) (table 3).

TABLE (2) Ratio of nasal septum deviation of control, labial and palatal impaction groups.

Septum deviation side		Control	Labial	Palatal	Total
Deviation	**N**	2	16	12	30
	%	10.0%	80.0%	60.0%	50.0%
No deviation	**N**	18	4	8	30
	%	90.0%	20.0%	40.0%	50.0%
Total	**N**	20	20	20	60
	%	100.0%	100.0%	100.0%	100.0%
Chi-square	**X^2**		**20.800**		
	P-value		**0.001***		

TABLE (3) Comparison of deviated septal length (DSL) between control and impaction groups and between labial and palatal impaction groups.

DSL	Control	Labial	Palatal
Range	0.60 – 2.28	1.22 – 5.82	1.81 – 3.69
Mean ± SD	1.42 ± 0.46	2.50 ± 1.86	2.65 ± 0.77
F. test		4.223	
P. value		0.022*	
Control & Labial	**Control & Palatal**		**Labial & Palatal**
0.020*	0.014*		0.756

Table 4 showed that, nasal septum was deviated to the same side of the impaction in all cases of the labial maxillary canine impaction with septal deviation but only 12 cases of palatally impacted maxillary canine group showed septal deviation to the same side of impaction.

TABLE (4) Compatibility of nasal septum deviation and the side of maxillary canine impaction in labial and palatal impaction groups.

Compatible		Labial	Palatal	Total
Yes	**N**	16	8	24
	%	100.0%	66.7%	85.7%
No	**N**	0	4	4
	%	0.0%	33.3%	14.3%
Total	**N**	16	12	28
	%	100.0%	100.0%	100.0%
Chi-square	**X^2**		**6.221**	
	P-value		**0.013***	

DISCUSSION

The aim of the current study was to assess the depth of the palate and the deviation of the nasal septum in patients with unilaterally maxillary impacted canine using CBCT.

Only patients over 12 years old were involved in the current study because radiographic investigation does not definite prognosis maxillary canine eruption prior to 11 years old.

CBCT is supposed to be the most valid diagnostic tool for assessing the position of maxillary impacted canine with lesser cost and exposure dose than CT. AS well as, it overcomes distortion and superimposition of panoramic radiographs [18,19].

The results of the present study demonstrated non-significant difference in palatal vault depth between the impaction groups and the control group. This result was previously disclosed by Fattahi et al., [20] and Cacciatore et al., [21]. On the other hand, Kim et al., [22] recorded deeper palatal vault in patients suffering from palatal canine impaction than those with buccal impaction. This contrast may be due to that, palatal depth was measured on digital model not CBCT scans. Also, they utilized a ratio to calculate the depth of the palate rather than absolute value.

Nasal septum is a medium structure that supports the nasal cavity. It is composed of bone, cartilage

and fibrous tissue. Deviation of the nasal septum can lead to nasal congestion and inadequate nasal breathing. A chronic nasal obstruction contributes to mouth breathing which narrows the transverse maxillary dimensions [5]. Decreasing the width of the upper arch forced the canine, which travels about 22 mm while erupting to be impacted or ectopic.

The results of the current study observed nasal septum deviation in 60 % of children with palatally impacted canine and 80 % of those with labially impacted canine. While the least ratio (10%) was recorded in subjects without impaction.

These findings are in accordance with Bektas et al., [23] who found buccally displaced maxillary canine as a result of deviated nasal septum.

Surprisingly, the present study showed that, the nasal septum was deviated to the same side of maxillary impacted canine in all subjects of the labial group and in 80% of those of the palatal impaction group.

Erhamza & Akon[24] thought that maxillary canine was ectopically displaced buccally due to narrowing of the maxillary arch as a result of deviated nasal septum. Their finding supports our results that revealed presence of maxillary canine impactions in subjects with deviated nasal septum. So, early diagnosis of nasal septum deviation is important to prevent many orthodontic problems such as narrow maxillary arch and impacted maxillary canine.

CONCLUSION

- Maxillary canine impaction can be expected when nasal septum is deviated.
- Labially impacted maxillary canine group has highest ratio of deviated nasal septum among the studied group.
- There is no statistically significant difference in the palatal depth between control group and impaction groups.
- Nasal septum was deviated to the same side of the labial maxillary impacted canine.

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