



Prevalence of Second Mesio-Buccal Canal in Maxillary First and Second Molars in Egyptian Population Using CBCT (A Cross-Sectional Study)

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Abstract

Introduction: The records of cone-beam computed tomography of permanent maxillary first and second molars amongst members of an Egyptian population was analysed in this study; a cross-sectional study.

Methods and Material: CBCT images of maxillary first and second molars (116), voxel size less than 0.2, average age 20-60 years in both sexes with minimum of one molar in the scan. Maxillary molars with fully formed apices; and no root canal fillings, posts, crown restorations were included.

Statistical Analysis: One way ANOVA and Pearson's chi-squared test tests were performed to detect significance between different categories.

Result: The prevalence of MB2 in maxillary first right molars was 65% and 76% in maxillary first left molars, while in maxillary second right molars was 40% and 59% in maxillary second left molars, there was no significant between the right and left side of the maxillary molars teeth. There was higher prevalence of type IV canal configurations in mesio-buccal root in the first molars and type I in the second molars according to Vertucci classifications; furthermore, it was more prevalent in males than females. As for the location of MB root canal curvature it was almost in the middle third and there were no significance differences between the right and left side of these teeth.

Conclusion: It can be concluded that in-vivo CBCT images evaluation appears to be a non-invasive and efficient in understanding the root morphology for improvement of the outcomes of root canal treatment.

Keywords: Second Mesio-buccal Canal; CBCT; Prevalence; Population; Permanent Maxillary First and/or Second Molars

Key Messages

Using CBCT in understanding the root morphology and root canal anatomy is clinically efficient tool for the improvement of the outcomes of root canal treatment.

Introduction

The complete debridement and disinfection of the root canal system are essential to increase the success of the root canal treatment outcome. So the clinician should be aware of the common root canal configurations and the possible variations. Based on published reports, the incidence of the second mesio-buccal canal in the first maxillary molars is (42%) while in the second maxillary molars is 34% [1]. So the current study aimed to assess the root

canal anatomy of the first and second maxillary molars in addition to the prevalence, location and angle of curvature in the MB2 canal.

Subjects and Methods

Selected radiographic scans

CBCT scans were included in our study collected from Photon Scan¹ and Dental school department of oral and maxillofacial radiology, Cairo University.

The CBCT scans were imaged with the following parameters:

- 90 kVp, 12 mA, 15 seconds exposure time,
- 150 µm voxel size and 10 x 6 cm FOV which included the whole maxilla using PLANMECA machine with Romexis viewer software.

¹Photon scan:104 Abbas El Akkad St., second floor, 6th district, Nasr City, Cairo
Telephone number: 0111 116 3354

Eligibility criteria of the scans included in our study

Inclusion criteria

- High arch images.
- CBCT with voxel size less than 0.2.
- Age 20 - 60 years, both sexes.
- Minimum of one molar in the scan.
- Maxillary molars with fully formed apices; and no root canal fillings, posts, crown restorations.

Exclusion criteria

- Images with voxel size more than 0.2.
- Images with missing all maxillary molars.
- Open apices.
- Root resorption.
- Calcifications or extensive coronal restoration.

Detection of MB2, type of MB root canal and number of root canals and roots of the maxillary first and second molars

- The axial plane was aligned with the hard palate and the sagittal plane with nasal septum (Figure 1a, 1b).
- The slice thickness of the axial images as well as the inter-slice thickness was adjusted to 0.15 mm.
- The axial images were scrolled along the whole length of the root for detection of presence of MB2, type of MB root canal, number of root canals and roots of the maxillary first and second molars (Figure 2a, 2b).

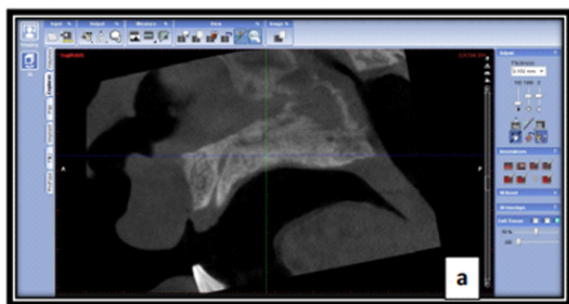


Figure a: Alignment of axial plane with the hard palate. (Sagittal view)

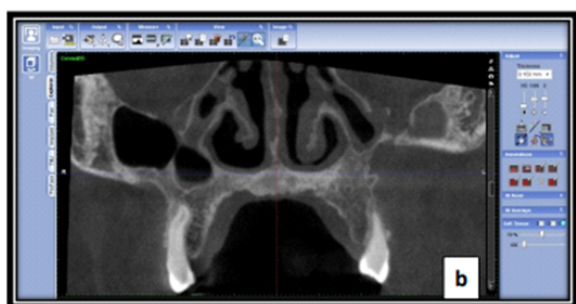


Figure b: Alignment of sagittal plane with nasal septum. (Coronal view)

Figure 1a, b: Two fixed plans of CBCT.

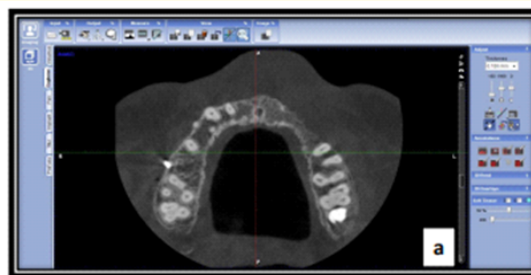


Figure a: The axial images were scrolled to detect the radiographic apex (Axial view)

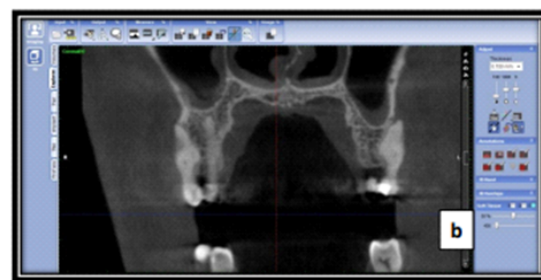


Figure b: Detection of MB2 and type of MB root canal (Coronal view)

Figure 2a, b: Detection of MB2, type of MB root canal and number of root canals and roots of the maxillary first and second molars.

Measurement of crown and root length of the maxillary first and second molars

- The axial images were scrolled to detect the radiographic apex for each root.
- On the axial image, the long axis of the coronal cuts was rotated to be perpendicular on the buccal cortex and become a “true cross-sectional cut”.
- On the sagittal image, the distance between CEJ and the radiographic apex was measured. This distance would be the root length.
- On the corrected coronal image which acted as a “true cross-sectional cut”, the most coronal cusp tip of the crown was detected. The distance between CEJ and the most coronal cusp tip were measured. This distance would be the crown length.

Location of MB root canal curvature and measuring its angle

- On the axial image, the long axis of the coronal plane was rotated to pass along the long axis of MB root in bucco-lingual direction and the long axis of the sagittal plan to pass along the long axis of the MB root in mesio-distal direction.
- On the coronal image, the long axis of sagittal plane was adjusted to pass along the long axis of MB root.

On the sagittal image, according to Schneider’s method, three points were detected. The first point was at the mid-point at the level of the canal orifice and labeled point A. The second point was marked where the flare starts to deviate that is labeled point B. A third point was marked at the apical foramen and was termed point C and the angle formed by the intersection of these lines is measured [2]. If the angle is less than 5°, the canal is straight; if the angle is 5 - 20°, the canal is moderately curved; and if the angle is greater than 20°, the canal is classified as a severely curved canal [2].

Location of the root canal curvature can be done by measuring the root length and dividing it in to 3 thirds (apical, middle, cervical) and then measuring the point of curvature according to these thirds.

Results

The sample of 122 patients was included in this study. The total number of teeth observed was 294 (173 female and 121 male molars), of which 138 were maxillary first molars, 68 rights and 70 left. 156 maxillary second molars were included: 83 rights and 73 left.

Prevalence of MB2, angle of MB canal curvature, location of MB2 canal curvature, number of root canal, type of MB canal and gender distribution

Prevalence of MB2 in right versus left side

The frequency of the prevalence MB2 canal in maxillary first right molars was 65% and 76% in maxillary first left molars. The frequency of the MB2 canal in maxillary second right molars was 40% and 59% in maxillary second left molars,

There is no statistically significant difference at the level of the present study ($P < 0.05$) between frequency of the MB2 canal in the maxillary first right/left molars and the in maxillary second right/left molars.

Canal curvature angle

The Canal curvature angle recorded mean of (29) in maxillary first right molars and (32 mm) in maxillary first left molars, (31) in maxillary second right molars and (32) in maxillary second left molars.

Location of the mesio-buccal root canal curvature along the root length

The location is almost in the middle third of the root in all the maxillary molars. There was no statistically significant difference ($P > 0.5$) between right and left sides.

Type of mesio-buccal root of the maxillary first and second molars

The most common Vertucci classifications for the mesiobuccal root for maxillary first molars were type IV root canal configuration. There were non-statistically significant differences regarding the root canal type between right and left molars (Table 1 and 2).

Root canal Type	Maxillary right first molar		Maxillary left first molar		P Value
	Count	%	Count	%	
I	24	35.3%	17	24.3%	0.14 NS
II	13	19.1%	15	21.4%	
IV	30	44.1%	37	52.9%	
V	1	1.5%	1	1.4%	

Table 1: Type of root canal of the maxillary first molars.

Root canal Type	Maxillary right second molar		Maxillary left second molar		P Value
	Count	%	Count	%	
I	50	60.2%	30	41.1%	0.10 NS
II	10	12.0%	20	27.4%	
IV	20	24.1%	23	31.5%	
V	1	1.2%	0	.0%	

Table 2: Type of root canal of the maxillary second molars.

Prevalence of mb2 in male versus female

The frequency of the MB2 canal in male patents (65%) was non-statistically ($P < 0.05$) more than that of female patients (55%).

Morphological characteristics of maxillary first and second molars

Crown length of the maxillary first and second molars

The crown length recorded mean of (6.23 mm) in maxillary first right molars and (6.20 mm) in maxillary first left molars. The

crown length recorded mean of (6.07 mm) in maxillary second right molars and (6.17 mm) in maxillary second left molars.

Number of roots of the maxillary first and second molars

The distribution of the number of roots of the included molars are shown in table 3.

Root no.	Maxillary right first molar		Maxillary right second molar		Maxillary left first molar		Maxillary left second molar	
	No.	%	No.	%	No.	%	No.	%
One	0	.0%	3	3.5%	0	.0%	3	4.1%
Two	2	2.9%	6	7.1%	4	5.7%	7	9.5%
Three	66	97.1%	76	89.4%	66	94.3%	64	86.5%

Table 3: Counted Number of roots of the maxillary first and second molars.

Discussion

In the presented retrospective study, 122 scans were included. The total number of teeth observed was 294 of which 138 were maxillary first molars (68 rights and 70 left) and 156 maxillary second molars were included (83 rights and 73 left). The frequency of the prevalence of MB2 canal in Egyptian maxillary first and second molars compare favourably with the percentage reported by the Greek [3] and Iranian [4] populations. The prevalence of MB2 differs among several races from our results and comparing with the other studies, it's apparent that the prevalence of MB2 in maxillary first molars is much more than that of the maxillary second molars.

The number of roots in maxillary first and second molars coincides with the Chinese [5], Korean [6], Taiwanese [7], Brazilian [1], Indian [8], Iranian [4], Spanish [9] and Greek [3] populations which their maxillary first and second molars consist mostly of 3 separate roots. As for the second maxillary molars have a higher percentage of fusion which was in agreement with Korean [6], Chinese [10] and Brazilian [1] populations.

The canal curvature location is mostly in the middle third of the root in all the maxillary molars and its severely curved.

Most of the mesio-buccal roots of maxillary first molars have type IV root canal configuration which is consistent with the Taiwanese [7] and Korean [6] populations and most of the maxillary second molars have type I root canal configuration which is consistent with the Indian [3], Korean [6], Iranian [4], Chinese [10] and Spanish [9] populations.

The presence of MB2 is not affected by sex, which was in agreement with Chinese [5], Korean [6], Taiwanese [7] and Brazilian [1] populations but it is more in men in Chinese [10] and Chilean [11] populations.

Clinical significance of the presented retrospective study

Number of scans provided basic information of accepted sample to define the prevalence of crown size, types of root canals, not to neglect the important incidence of MB2 in maxillary first and second molar. In the present study the prevalence and degree of canal curvature of MB2 was assessed. The frequency of anatomic variations may not be high but it is important for the clinician to have the knowledge of maxillary molars oddity to prevent mishaps in endodontic treatment and reach the treatment success.

Conclusion

In the presented retrospective study, the incidence of MB2 in maxillary first right molars was 65% and 76% in maxillary first left molars. The prevalence of the MB2 canal in maxillary second right molars was 40% and 59% in maxillary second left molars, there was no significant between the right and left side of the maxillary molars teeth.

There was higher prevalence of type IV canal configurations in first molars and type I in the second molars; furthermore, it was more prevalent in males than females. As for the location of MB root canal curvature it was almost in the middle third and there were no significance differences between the right and left side of these teeth.

The prevalence of variations of MB2 and morphological differences found in mesio-buccal roots did occur in different populations as seen in the table below. Consideration during surgical or nonsurgical endodontic procedures of the permanent maxillary molars to define the existence of prevailing extra root canals should be taken.

It can be concluded that in-vivo CBCT images evaluation appears to be a non-invasive and clinically efficient tool in understanding the root morphology and root canal anatomy for the improvement of the outcomes of root canal treatment.

Author	Year	Race	Prevalence of I1EB2 canal	
			First molars	Second molars
Zhang., <i>et al.</i>	2010	Chinese	52%	32%
Kim., <i>et al.</i>	2010	Korean	63.59%	34.39%
Rais., <i>et al.</i>	2013	Brazilian	86.1%	87.5%
Nikoloudaki., <i>et al.</i>	2015	Greek	53%	40.29%
Betancourt., <i>et al.</i>	2016	Chilean	69.82%	46.91%
Tian., <i>et al.</i>	2016	Chinese	53.90%	22.90%
Lin., <i>et al.</i>	2017	Taiwanese	56%	7.80%
Khademi., <i>et al.</i>	2017	Iranian	70.20%	43.40%
Salma., <i>et al.</i>	2018	Egyptian	70.2%	49.35%

Racial prevalence of MB2 using CBCT in the maxillary first and second molars.

Recommendation

Studying the prevalence of second mesio-buccal canal in maxillary first and second molars in Egyptian population using periapical parallel radiographic technique in correlation with the CBCT.

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