

ORIGINAL ARTICLE

Usage of Cone-Beam Computed Tomography (CBCT) to Evaluate Root and Canal Morphology of maxillary First Molar

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ABSTRACT

Frequency identify of root and canal morphology of the first maxilla molars by Vertucci & Weine classification method by Cone-Beam Computed Tomography (CBCT). In this descriptive study, archive CBCT images of a radiology center in Qazvin City in 2012 were used. CBCT Images of 522 dossiers were studied. There were no periapical lesions and endodontic treatment in the studied population. Also root canal was not open apex and CBCT images with high quality were used. Images were evaluated with Romexis software 19 inches Samsung monitor with 1024×1024 pixels resolution. Optimal light was regulated with software automatically. Images were evaluated with one dental radiologist and two endodontic simultaneously for their agreements. Variables of this study were: number of roots and their morphology, number of canals in mesiobuccal, distobuccal and palatal roots. Number of 522 CBCT were evaluated that number of 200 CBCT (119 of the first maxillary molar) had the experimental conditions and the others were eliminated due to lack of condition. Frequency of three and two roots of first molar was 94.1% and 5.9%, respectively. Type of mesiobuccal three roots of first molar in Vertucci classification were Type I, Type II and Type V with 27.7%, 31.3% and 34.8% frequency respectively. Type of distobuccal and palatal roots in Vertucci classification were Type I with 99.1% and 100% frequency respectively. Majority of the first maxilla molars were three-rooted and two-rooted molars had very low frequency and there was no single root in this case. However majority of distobuccal and palatal roots of the first molars had one canal. While one and two canals were observed in the mesiobuccal roots in high frequency. Therefore it is importance that pay attention to the this case

Keywords: morphology, root canal, first molar, second molar, Vertucci, Weine

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INTRODUCTION

Today, with the formation of modern dentistry, endodontic treatment is always an effective and important method in order to preserve teeth. Thorough knowledge of the anatomy of the tooth and root canal is necessary precondition for success treatment. Without knowledge of anatomy of the pulp after wrong diagnosis and treatment are the second leading causes of failure treatment [1]. So with acquaintance of the internal morphology is necessary to debridement, root canal filling and better prognosis [2]. Anatomy of the root canal system is very complex and can also vary not only in the teeth, but also a kind of teeth [3]. In this case, anatomy of maxillary molars is one of the most complex anatomies [4]. Several studies have shown that root canal anatomy is rarely a single uniform conical channel [5] and presence of additional channels, anastomoses and other irregularities are indicated this case [6]. Various ways, such as radiography, staining has been used to considering the root canal system [7-9]. Due to recent advances in the field of radiology and imaging of three-dimensional of human body, in vivo research of root canal system is provides and possible [10]. Therefore, this study was designed to determine the frequency and root canal morphology of maxillary first molars using CBCT by classification of vertucci and weine.

MATERIALS AND METHODS

This study was a descriptive - analytic. In this considering, data were obtained from CBCT images of archive of a radiology center in 2011 in Qazvin city. The 522 CBCTs were reviewed. The maxillary molars in the population sample had the following criteria:

a) no periapical lesions, b) roots were not treated, c) absence of canals open apex, d) high quality of CBCT images. The following formula was used to determine the sample size [11] and was considered at least 114 teeth.

$$n = \frac{z^2 \times \delta^2}{e^2} = \frac{1.96^2 \times (0.4 \times 0.6)^2}{0.09^2} \cong 114$$

Images were analyzed with Romexis computer software. A Samsung 19 inch LCD Monitor was used in 1024 × 1024 pixel resolution. In order to have an optimal image clarity, illumination and brightness of images were adjusted by software. Images were examined by a radiologist and two endodontists simultaneously until all three observers were agreed in result of considering of each image. After agreement of three observers, data were recorded in one table. The measured variables were included: number of roots and their morphology, number of channels in mesiobuccal, palatal and distobuccal roots. Also demographic characteristics were recorded. The Kappa test was used to determination of the similarity of anatomical variation of left and right first maxillary molars. Following classification was used to study the variation in the morphology of the root canal (fig. 1) [12]:

Variant I. A separately three roots with one canal in each root.

Variant II. A separately three roots with one canal distobuccal and palatal roots and two canals in mesiobuccal root.

Variant III. Two separate roots, one of them in buccal and the other one in palatal with one canal in each root.

Variant IV. Two separate roots, one of them in mesial and the other in distal and one canal in each root.

Variant V. One root and a one canal.

Variant VI. One root with two canals.

Variant VII. One root with three canals.

Variant VIII. Three roots with one canal in mesiobuccal and palatal roots and two canals in distobuccal root.

Variant IX. Two distinct roots in the buccal (with two canals) and lingual, buccal root with one canal.

Variant X. Three distinct roots with two canals mesiobuccal and distobuccal roots and one canal palatal root.

RESULTS AND DISCUSSION

A total of 119 cases of the 522 cases were eligible for the study. Others due to lack of condition, were excluded. From 119 maxillary first molar, 64.7% (77 cases) were for female and 35.3% (42 cases) were for male. The age average of the patients was 39.7±8.4 years. The minimum and maximum ages of patients were 21 and 58 years respectively. 52.1% of the first maxillary molars were placed in the left and 47.9% were in the right. 13.4% (16 cases) of maxillary first molars were unilateral and 17.6% (21 cases) were bilaterally. 68.9% (82 cases) of patients had unilateral CBCT, therefore there was no impossible for considering the other side of first molar. The most frequency was observed for Variant I and variant II with 62.2% and 31.1%, respectively (Table 1).

The other variants were defined as follows:

Variant XI: 0.8% (1 case) with two roots: one mesiobuccal root with three and one distopalatal root with three canals.

Variant XII: 0.8% (1 case) with two roots: one mesial root with one canal and one distal root with two canals.

Variant XIII: 1.6% (2 cases) with two roots: one mesial root with two canals and one distopalatal root with two canals.

Overall, 112 patients (94.1%) had three-rooted first maxillary molar and 7 patients (5.9%) had two roots. The results of the surveying of canal morphology in each root on the base of Vertucci's root canal classification (112 three-rooted first molars) were presented in Table 2. Type I, Type II and Type IV had the highest frequency with 27.7%, 31.3% and 34.8% in mesiobuccal root, respectively. 99.1% of distobuccal roots and 100% of the palatal roots were Type I.

The following cases were observed at 7 first molars teeth with two roots on the base of Vertucci's classification.

a) Mesiobuccal root: Type II in 4 cases and Type III in 2 cases.

b) Distopalatal root: Type I in 1 case, Type II in 1 case, Type III in 1 case and Type V in 3 cases.

c) Buccal root in Type II and palatal root in Type I was observed in one tooth.

The results of the survey of the root canal morphology on the base of Weine's classification for 112 three-rooted first molar teeth were presented in Table 3. In the mesiobuccal root, Type I, Type II and Type III, were 33.1% 31.3% and 35.6%, respectively. 99.1% of distobuccal roots and 100% of palatal roots were Type I.

The following cases were observed at 7 first molars teeth with two roots on the base of Weine's classification.

- a) mesiobuccal root: Type I in 2 cases and Type II in 4 cases.
- b) distopalatal root: Type I in 1 case, Type II in 2 cases, Type III in 3 cases.
- c) buccal root in Type II and palatal root in Type I was observed in one tooth.

Variants of the left and right first three-rooted molars has three roots were quite similar and kappa coefficient was 1 and significant ($P < 0.01$). while mesiobuccal root of the left and right first molars were differenced in 10% cases on the base of Vertucci's classification but kappa coefficient was 0.855 and significant ($P < 0.01$). Also distobuccal and palatal roots were the same in Vertucci's classification and kappa coefficient was 1 and significant ($P < 0.01$). Inadequate information and ambiguity of information and the anatomy, numerous and morphology of the teeth were causing errors in diagnosis and treatment management. For these reason, entire treatment process will fail. Furthermore, the radiograph as a diagnostic tool in the endodontic treatment has limitations due to the two-dimensional. Therefore dentist should be aware from the various possible forms of the root canal root for success canal treatment. With having accurate statistics on the number and different types of root canals and presence possible of additional canals, Probability of failure treatment will be minimized. In this study, 94.1% of first maxillary molars were three-rooted and 5.9% were two-rooted. There was no single root in the maxillary first molar. Zhang et al [12] reported that all of first molars and had three roots. Ng et al [13] showed that all first molars of the Burmese had three roots. These results were slightly different with results of present study. While results of Blaine et al [14] showed that over 95% of maxillary first molar had three roots and only 3.9% had two roots which were agreed with the results of present study. Similar to these results were seen in research of Kim et al [19] in identify the root and canal morphology of maxillary first molars in a Korean population by CBCT. Their results were indicated that 97% of first molars were three-rooted. In the surveying of morphological variation of root and canal in maxillary first molars, variant I and II had the most frequency 31.1% and 62.2%, respectively. In this study, canal shape in each root on the base of Vertucci's classification was showed that over 99% of the palatal root and over 98% of the buccal root were Type I with one canal and were similar to other studies (13-16, 18). The results of the survey in the three-rooted maxillary first molar on the base of Vertucci's classification were indicated that Type I, II and IV with frequency 34.8%, 31.3% and 27.7%, respectively were the most frequency in the mesiobuccal root. Studies of Neelakantan et al [18] in the morphology of the first molar root canal were showed that there were lower molars with two canals in the mesiobuccal roots. Prevalence of mesiobuccal roots with two canals was reduced from first molar to third molar (68%, 49%, 39%) in the studies of Ng et al [13]. Study of Blaine et al [14] was showed that the average of two canals and single canal in mesiobuccal root was 56.8% and 43.1%, respectively. Frequency of two canals in mesiobuccal root in the laboratory reports (60.5%) was higher than clinical reports (57.4). clinical studies of Hartwell et al and Somma et al were indicated that the additional canals were found in mesiobuccal roots in most cases. Filho et al (2009) found that additional canal in mesiobuccal roots were seen in over 50% cases by clinical and ex vivo methods and in 37% by CBCT method. Studies of Kim and Zhang indicated that second canal was seen in over 50% cases in mesiobuccal root. The results of the survey in the root canal morphology of three-rooted maxillary first molar on the base of Weine's classification were indicated that distobuccal and palatal roots was almost Type I in all cases. The mesiobuccal root of all kinds of Type I, Type II and Type III were 31.3%, 35.7% and 33%, respectively, and additional canals were observed in 67% of cases. The results of Lee et al [11] in root canal morphology of maxillary first molars in a Korean population using CBCT were indicated that the prevalence of two canals in the mesiobuccal root was 71.8% in Type II and III. They concluded that Type II and III canal configuration in the mesiobuccal root of the maxillary first molar with two canals had the largest prevalence in the Korean population. In this study, agreement of variant of left and right maxillary first molars was surveyed. Variants of the left and right first molars were quite similar. This result was seen in mesiobuccal root of the left and right first molar on the base of Vertucci's classification. This accommodation was 0.85 and significance. Thus, the variants of the left and right maxillary first molars and mesiobuccal roots classification (in Vertucci's classification) were equal in the investigated population. These results were similar to results of Kim in correlation coefficient of left and right maxillary first molars.

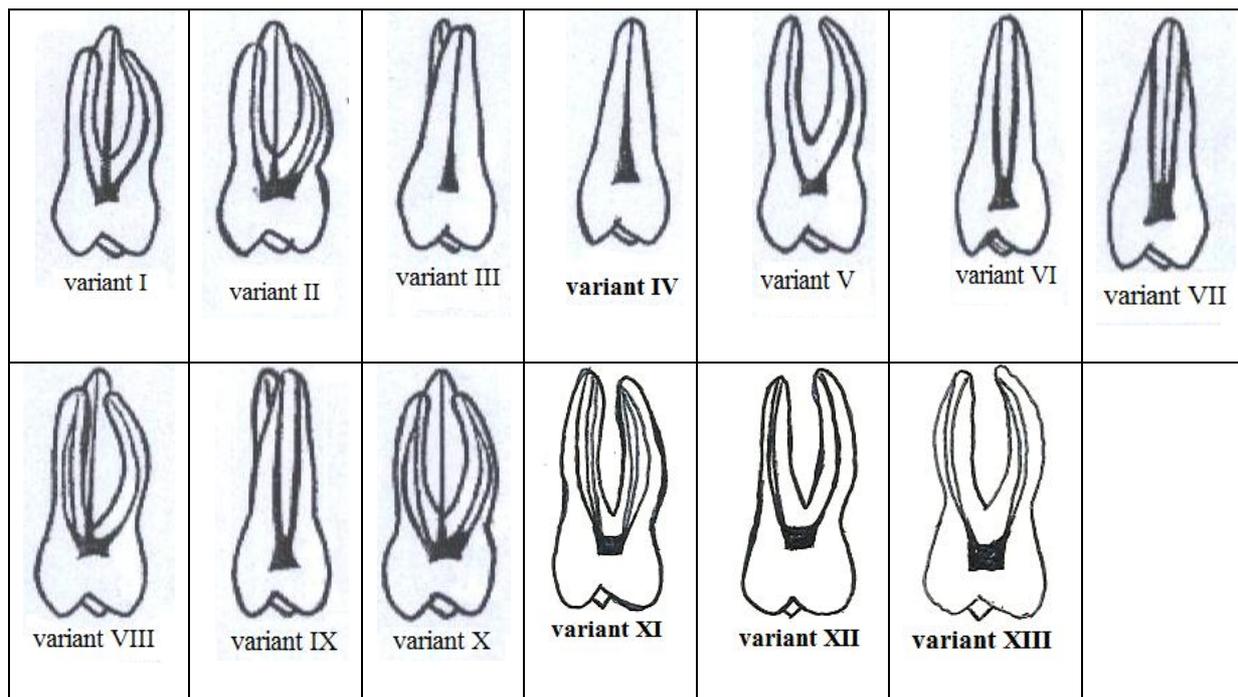


Fig. 1: Variation in the morphology of the root canal

| | | |
|--------------|------|----|
| variant I | 31.1 | 37 |
| variant II | 62.2 | 74 |
| variant III | 0.8 | 1 |
| variant IV | 0.8 | 1 |
| variant IX | 0.8 | 1 |
| variant X | 0.8 | 1 |
| variant XI | 0.8 | 1 |
| variant XII | 0.8 | 1 |
| variant XIII | 1.6 | 2 |

Table 1: The frequency distribution and diversity of root canal morphology of the first maxillary molar.

| Type Root | Type I | Type II | Type III | Type IV | Type VI |
|-------------|-------------|------------|----------|------------|----------|
| Mesiobuccal | 27.7% (31) | 31.3% (35) | 3.6% (6) | 34.8% (39) | 0.8% (1) |
| Distobuccal | 99.1% (111) | 0.9% (1) | | | |
| Palatal | 100% (112) | | | | |

Table 2: The frequency distribution of the root canal in maxillary first molar on the base of Vertucci's root canal classification.

| Type Root | Type I | Type II | Type III |
|-------------|-------------|------------|------------|
| Mesiobuccal | 33.1% (37) | 31.3% (35) | 35.6% (40) |
| Distobuccal | 99.1% (111) | 0.9% (1) | |
| Palatal | 100% (112) | | |

Table 3: The frequency distribution of root canal morphology of first maxillary molar on the base of Weine's classification.

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