

Prevalence of Three-Rooted Mandibular Permanent First Molars among the Babylon City Population

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Abstract

Background: The possible variations of anatomical and morphological characteristics of the teeth are very important especially for the endodontic practitioners.

Purpose: The purpose of the present study was to evaluate the prevalence of three rooted mandibular permanent first molars in a Babylonian population radiographically.

Materials and methods: Periapical radiographs of 420 subjects, which had been obtained in the Department of Oral Diagnosis, college of dentistry at Babylon University, Babylon people from June 2013 to March 2014, were screened and examined retrospectively. Comparison of the incidence and the correlations between males and females and left- and right-side occurrences were analyzed by using the Pearson chi-square test with SPSS (15.0; SPSS Inc., Chicago, IL, USA).

Results: The periapical radiographs of 17 patients, 9 females and 8 males, had three rooted mandibular first molars. Among these three-rooted mandibular first molars, 5 were found on the right side and 9 on the left side. The overall incidence of patients with three-rooted mandibular first molars was 4.05%. The incidence was 4% for men and 4.1% for women.

Conclusion: The prevalence of three-rooted mandibular first molars from all teeth examined was 2.6% (20 of 779), 2% (8 of 398) for the right side, and 3.1% (12 of 381) for the left side occurrences.

Key words: Anatomy, radix entomolaris, Babylon population.

الخلاصة

الخلفية: التغيرات الممكنة للصفات التشريحية والشكلية للأسنان مهمة جدا وخاصة للعاملين في حشوات جذور الأسنان .

الغرض: الغرض من هذه الدراسة لتقييم انتشار الأضراس الأولى ثلاثية الجذور في الفك السفلي بين سكان بابل إشعاعيا.

المواد والطرق: اشعة ماحول الجذر ل 420 شخص والتي تم الحصول عليها من قسم التشخيص ألقي ل كلية طب الأسنان جامعة بابل وللفترة من حزيران 2013 إلى آذار 2014 حيث تم الفحص بأثر رجعي. كل الاشعات تم تقييمها باستخدام عدسات مضاعفة التكبير. ولمقارنة مدى حدوث والعلاقة بين الذكور والإناث حلت باستخدام Pearson chi-square test with SPSS.

النتائج: اشعات ما حول الجذر ل 17 مريض 9 إناث و 8 ذكور لديهم ثلاثة جذور في الضرس الأول للفك السفلي. ومن هؤلاء الأضراس الأولى ثلاثية الجذور للفك السفلي وجدت 5 في الجانب الأيمن و 9 في الجانب الأيسر. وإجمالي نسبة المرضى ذوو الأضراس الأولى ثلاثية الجذور للفك السفلي كانت 4,05 % . وكانت نسبة الذكور 4% والإناث 4,1%.

الاستنتاج: انتشار الأضراس الأولى ثلاثية الجذور في الفك السفلي من كل الأسنان المفحوصة 2,6% (20 من 779), 2% (8 من 398) كانت للجانب الأيمن , 3,1% (12 من 381) للجانب الأيسر.

الكلمات الدالة: تشريح اشعة الاسنان , سكان بابل.

Introduction

Root canals may be left untreated during endodontic therapy if the dentist fails to identify their presence, particularly in teeth with anatomical variations or extra root canals (Sperber and Moreau, 1990). Therefore, a thorough radiographic examination, including preoperative radiographs, is essential for success in endodontic therapy. An apex locator can help in determining the working length during root canal treatment, but it cannot replace periapical radiography because it does not provide the detailed

information about root canal morphology that radiography does. Anatomical variations are acknowledged characteristics of mandibular permanent molars (Juan *et al.*, 2002). Most mandibular first and second molars in Caucasians have 2 roots, with 2 mesial canals and 1 distal canal (Sidow *et al.*, 2001).

Mandibular first molars being the earliest permanent teeth to erupt, show a high rate of caries and most commonly indicated for root canal treatment. One of the main reasons for the failure of the root canal treatment is the incomplete removal of pulp tissue and micro organisms from the root canal system which could be due to missed roots or root canals. The number of roots in mandibular permanent molars differs significantly in various races and these variations appear to be genetically determined. These variations in the root canal morphology should be identified before and during the procedure for successful endodontic treatment.

The possible variations of anatomical and morphological characteristics of the teeth are very important especially for the endodontic practitioner. Before beginning any kind of endodontic treatment, the clinician must always taken into account the morphological variations in pulp anatomy. Among all human teeth, the mandibular first permanent molar is one of the most important. It is often affected by caries and usually needs root canal treatment, even at an early age. For the success of its endocanalicular treatment, dentists need to locate all root canals, debride them entirely, and after that fill the whole endocanalicular system with an inert root filling material (Calberson *et al.*, 2007).

The presence of a third root in the permanent first molar is the major variant in this group. The frequency of this trait is less than 5% in Caucasian, African, Eurasian and Indian populations, whereas it occurs in 5% to more than 40% of people of Mongolian origin (Gulabivala *et al.*, 2001).

A variation in the number of roots and root canal morphology is not common in mandibular permanent first molars. Presence of an additional third root located distolingually was first mentioned in the literature by Carabelli, called the radix entomolaris (RE) (Calberson *et al.*, 2007). An additional root at the mesiobuccal side is called the radix paramolaris (RP). The identification and external morphology of these root complexes, containing a lingual or buccal supernumerary root, are described by Carlsen and Alexandersen (Carlsen and Alexandersen, 1990)

The canal in the additional distolingual root was left untreated during initial endodontic treatment in a 3- rooted mandibular first molar because radiographic examination was not carried out previously.

Table (1):Prevalence of three-rooted mandibular permanent molars from other studies done.

Author/year	Prevalence (%)	Population group
Taylor (1899)	3.4	United kingdom
Tratman (1938)	5.8	Chinese
Stidmore and Bjorndal (1972)	2.2	Caucasians
Walker and Quackenbush(1985)	14.65	Hongkong Chinese
Loh (1990)	7.9	Chinese(Singapore)
Yones et al. (1990)	2.92	Saudi
Ferraz and pecora (1992)	11.4	Japanese
	2.8	Negroid
Yew and chan, (1993)	21.5	Chinese
Gulabivala et al ,(2001)	10.1	Burmese
De Moor (2004)		Caucasian

Materials and methods

Periapical radiographs of 420 subjects, which had been obtained in the Department of Oral Diagnosis, college of dentistry at University of Babylon, Babylon people from June 2013 to March 2014, were screened and examined retrospectively. The bilateral eccentric periapical radiographs (30° mesial angulation with protractor) of patients who visited the Department of Restorative Dentistry for treatment of either pain or caries in the mandibular molars were obtained. Each of these patients had at least one mandibular first molar and was of Iraqi origin. Demographic details including age, sex, and race of all these patients were recorded. To reduce radiographic misinterpretation, blurred images of teeth were excluded (Rupali *et al.*, 2013).

The criteria for the indication of an extra root were adopted from recent studies (Schafer *et al.*, 2009) and the presence of an extra root was indicated by the crossing of the translucent lines defining the pulp space and periodontal ligaments. The incidence of three-rooted mandibular first molars and the prevalence of the bilateral appearance of such teeth were assessed. The ratio of such teeth and the comparison of the occurrence between genders and the occurrence on the right or left sides were also estimated.

Comparison of the incidence and the correlations between males and females and left- and right-side occurrences were analyzed by using the Pearson chi-square test with SPSS (15.0; SPSS Inc., Chicago, IL, USA).

Results

Periapical radiographs of 420 patients, 220 females and 200 males, with age range of 15-72 years and average age of 30.3 ± 12.5 years, were studied. The periapical radiographs of 17 patients, 9 females, and 8 males, had three-rooted mandibular first molars. A total of 779 periapical radiographs of mandibular first molars comprising 398 right and 381 left molars were evaluated (Table 2). Among these three-rooted mandibular first molars, 8 were found on the right side and 12 on the left side. The overall incidence of patients with three-rooted mandibular first molars was 4.05% (Table 2). The incidence was 4% for men and 4.1% for women (Table 2). The prevalence of three-rooted mandibular first molars from all teeth examined was 2.6% (20 of 779), 2% (8 of 398) for

the right side and 3.1% (12 of 381) for the left side occurrences (Table 2). There was no statistical significant difference in the incidence of three rooted mandibular first molars between female and male patients ($\chi^2 = 0.5877$, $P > 0.05$) but there was a statistical significant difference between the right- and left-side occurrences ($\chi^2 = 13.75$, $P < 0.05$). The bilateral incidence of symmetrical distribution was 17.6% (3 of 17). The Figures 1 shows example of radix entomolaris on formed periapical radiograph.

Table (2) :Number and percentage of three rooted mandibular first molars.

No. of patients and teeth		No. of three-rooted mandibular first molars							
		Right		Left		Bilateral		Total	
		No.	%	No.	%	No.	%	No.	%
Female	220	3	1.36	4	2	2	0.9	9	4.1
Male	200	2	1	5	2.5	1	0.5	8	4
Total patients	420	5	1.2	9	2.1	3	0.7	17	4.05
No. of all right first molars examined	398	5	1.2	----	-----	3	0.7	8	2
No. of all left first molars examined	381	-----	-----	9	2.4	3	0.8	12	3.1
Total teeth	779	5	0.64	9	1.15	6	0.8	20	2.6



Figure 1: Radix entomolaris in mandibular first molar.

Discussion

Internal and external anatomy of teeth have shown that anatomical variations can occur in each group of teeth, in each person and in general in each racial group. This can be called normal, in other words, it is present in most cases, but anatomical alterations ought to be expected as a frequent possibility (Bansal and Ajnani, 2010). The etiology behind the formation of this additional root is still unclear. In dysmorphic, supernumerary roots, its formation could be related to external factors during odontogenesis, or to penetrance of an atavistic gene or polygenetic system (atavism is the reappearance of a trait after several generations of absence). In eumorphic roots, racial genetic factors influence the more profound expression of a particular gene that results in the more pronounced phenotypic manifestation (Calberson *et al.*, 2007).

The nature of this additional third root is variable which can be present as full length root or a short conical projection. According to the present study, the occurrence of three rooted mandibular first molar in Babylon population was 4.05 % which was more than which was observed by Stidmore and Bjorndal in 1972 in Caucasians population but at the same time less than that observed in other Asians (Table-1). The frequency of the extra distal root in the present study and the differences compared with those studies listed in Table – 1 indicate that the three rooted variation of the mandibular first molar may be genetic characteristic to an Asiatic racial background. In the present study there was no significant difference according to sex [in male 4% and female 4.1%] which is agreement with the previous studies which state that such dental aberrations did not differ with gender (Rwenyonyi *et al.*, 2009). There was a considerable difference according to the side of occurrence [right -2% and left -3.1%] and this agrees with other studies reported that three rooted mandibular first molar occurred more frequently on the right side than on the left side (Rwenyonyi *et al.*, 2009). Among the images of 420 patients; three patients displayed bilateral (0.7%) occurrence (Table 2).

In populations with Mongoloid traits (such as the Chinese, Eskimo and American Indians) reports have noted that the three rooted mandibular permanent first molars occur with a frequency that ranges from 5% to more than 30%. Because of its high frequency in these populations, it is considered to be a normal morphological variant (eumorphic root morphology). In Caucasians it is not very common and, with a maximum frequency of 3.4 to 4.2%, is considered to be unusual or dysmorphic root morphology. The result of our study was found to be lower than the previous studies done by De Moor, Ferraz and Pecora, and Walker, where they have compared the prevalence in various racial groups (Africans, Caucasians, Eurasians, Asians and Mongolians) all concluding that the greatest prevalence was in Mongolians/Asians. Negros and Caucasians were found, in descending order respectively, to have significantly less frequent prevalence of three-rooted lower molars. In African and Indian populations the frequency is less than 5% and so it is considered as unusual or dysmorphic root morphology (Walker, 1988, De Moor *et al.*, 2004). A study conducted by Garg *et al.* showed a prevalence of 5.97% three rooted mandibular molars among the Indian population (Grag *et al.*, 2010).

We found that the incidence of bilateral permanent three rooted mandibular molars was 17.6% (3 of 17 individuals), which is lower than the percentages found (56.6-68.57%) in several research studies involving Asian subjects (those of Japanese and Chinese descent) (Carabelli, 1844; de Souza-Freitas *et al.*, 1971; Tu *et al.*, 2007) and

which was more than the recent study (Schafer *et al.*, 2009) among the German population (0%).

The incidence of three rooted mandibular molars in our study was found in female patients (4.1%) when compared to male patients (4%). This difference was found to be statistically not significant (Table 1). This agreed with Ming-Gene *et al.*, where they concluded there was no statistical gender related difference (Tu *et al.*, 2009).

In the present study the left side had higher incidence (2.43%) than the right side (1.2%) of the mandible. Interestingly the result of our study was in agreement to that of Walker and Quackenbush, unilateral three-rooted first molars were mainly noted on the left side (Walker and Quackenbush, 1985). However in our study there was no statistically significant difference in the incidence between the right and left side of the mandible, which was similar to the result of Garg *et al.* (Garg *et al.*, 2010).

Conclusion

Knowledge of both normal and abnormal anatomy of the molars dictates the parameters for execution of root canal therapy and can directly affect the probability of success. Mandibular first molar is the earliest permanent posterior tooth to erupt. It seems to be the most frequently in need of endodontic treatment. It usually has two roots (mesial and distal), but occasionally three, with a supernumerary distolingual root. Radix entomolaris may present the clinician with a lot of difficulties during endodontic treatment. An accurate diagnosis of a Radix entomolaris before root canal treatment is important to facilitate the endodontic procedure, and to avoid missed canals. Preoperative periapical radiographs, exposed at two different horizontal angles (mesial/distal) are required to identify this additional root. Knowledge of the location of the additional root and its root canal orifice will result in a modified opening cavity with extension to the distolingual. The morphological variations of the RE in terms of root inclination and root canal curvature demand a careful and adapted clinical approach to avoid or overcome procedural errors during endodontic therapy. Therefore, practitioners must be familiar with all molar abnormalities, as well as their prevalence.

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