

Prevalence of three-rooted mandibular permanent first molars among the Turkish population

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Abstract

Background: This retrospective study was undertaken to determine the prevalence of three-rooted permanent mandibular first molars in digital periapical radiographic images obtained from a Turkish patient.

Materials and Methods: Periapical radiographs of 640 subjects, which had been obtained in the Department of Oral Diagnosis Radiology, Kırıkkale University Dental Faculty, Kırıkkale, Turkey from June 2010 to March 2011, were screened and examined retrospectively. All radiographs were evaluated under optimal conditions using double magnifying glasses. Each radiograph was separately evaluated by two authors (H.Ç. and M.M.H.). 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 9 patients, 4 females and 5 males, had three-rooted mandibular first molars. Of these three-rooted mandibular first molars, 7 were found on the right side and 5 on the left side. The overall incidence of patients with three-rooted mandibular first molars was 1.41%. The incidence was 1.63% for men and 1.2% for women.

Conclusion: The prevalence of three-rooted mandibular first molars from all teeth examined was 1% (12 of 1205), 1.17% (7 of 596) for the right side, and 0.82% (5 of 528) for the left side occurrences.

Key words: Anatomy, radix entomolaris, turkish population

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Introduction

Knowledge of both basic root and root canal morphology as well as possible variation in anatomy of the root canal system is important in achieving successful nonsurgical root canal treatment (NSRCT). This is followed by negotiation, cleaning and shaping, and obturation of the entire canal system in three dimensions.^[1-3] Knowledge of root and root canal anatomy is extremely important for locating and negotiating canals for thorough canal debridement and to prevent misdiagnosis as well as errors during instrumentation, all of which influence the success rate of endodontic treatment.^[4] Failure to recognize variations in root or root canal anatomy can result in unsuccessful endodontic treatment. Therefore, it is imperative that the aberrant anatomy is identified before and during the root canal treatment of three-rooted mandibular first molars.

The number of roots in mandibular first permanent molars in various races differs significantly.^[5] These variations appear to be genetically determined,^[6] and so are important in identifying racial origins of populations. The third root usually appears as a thin strand in the disto-lingual position, which was first mentioned in the literature by Carabelli,^[7] and termed radix entomolaris (RE).^[8] This extra root is typically smaller than the distobuccal root and is usually curved, requiring special attention when root canal treatment is being considered for such a tooth.^[9-11]

In European populations it has been reported that a separate RE is present in the mandibular first molar with a maximum frequency of 3.4–4.2% [Table 1].^[15,16,34,35]

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In African populations a maximum of 3% is found.^[23,36-38] In Eurasian and Indian populations the frequency is less than 5%.^[12] In populations with Mongoloid traits, such as Chinese, Eskimo, and American Indians, the RE occurs with a frequency of 5% to more than 40% [Table 1].^[12,14,15,17,18,19,21,22,26,39] Because of its high frequency in mongoloid populations, the RE is considered to be a normal

morphologic variant or eumorphic root morphology^[40] and can be seen as the Asiatic trait.^[27] Among Caucasians, RE is not very common^[26,35] and is considered to be an unusual or dysmorphic root morphology.

This retrospective study was undertaken to determine the prevalence of three-rooted permanent mandibular first

Table 1: Survey of available studies by extracted teeth and periapical radiographs on the prevalence of three-rooted mandibular first molars 3% RM1, % of three-rooted mandibular first molars

Authors	Year	Area of origin	No. of teeth/person			Periapical radiographs			
			Sample	Gender (M/F)	3%RM1	3% RM1			
						Gender (M/F)	Right	Left	Bilateral
Tratman ^[12]	1938	Chinese	1615		5.80				
		Malay	475		8.60				
		Javanese	110		10.9				
		Indians*	453		0.20				
		Eurasians	262		4.20				
		Japanese	168		1.20				
Laband ^[13]	1941	Malaysian	134		8.20				
Somogyl-Csizmazia and Simons ^[14]	1971	Canadian	250		15.6				
		Indians†							
de Souza-Freitas et al. ^[15]	1971	European descent	422		3.20				
Skidmore and Bjorndahl ^[16]	1971	White	45		2.2				
		Japanese descent	233	135/98	17.8	1.65/1	9.87	12.88	22.75
Turner ^[17]	1971	Aleutian Eskimo	263		32.0				
		American Indians ^l	1983		5.80				
Curzon and Curzon ^[18]	1971	Keewatin Eskimo	98		27.0				
Curzon ^[9]	1973	Baffin Eskimo	69		21.7				
Hochstetter ^[19]	1975	Guam	400		14.3	2/1			
Jones ^[20]	1980	Chinese	52		13.4				
		Malaysian	149		16.0				
Reichart and Metah ^[21]	1981	Thai	364		19.2				
Walker and Quackenbush ^[22]	1985	Hong Kong Chinese	213		14.6				
Steelman ^[23]	1986	Hispanic children	156	73/83		1.50/1	2.60	0.60	3.20
Walker ^[6]	1988	Hong Kong Chinese	100		15.0				
Harada et al. ^[24]	1989	Japanese	2331		18.8				
Loh ^[25]	1990	Singaporean Chinese	304		7.9				
Ferraz and Pécora ^[26]	1992	Japanese descent	105			1/1			11.4
		Negro	106						2.80
		White	117						4.20
Yew and Chan ^[27]	1993	Chinese	179						21.5
Gulabivala ^[28]	2001	Burmese	139		10.1				
Gulabivala ^[29]	2002	Thai	118		13.0				
Huang et al. ^[30]	2007	Taiwanese	332		21.7				26.9
Tu et al. ^[31]	2007	Taiwanese	332	79/87	17.77	0.75	4.22	2.41	14.46
Schafer et al. ^[32]	2009	Germans	524	264/260	0.68	1.33	0.57	0.76	1.34
Garg et al. ^[33]	2010	Indians	586	266/320	5.97	1/1.2	1.23	0.85	2.47

*Indian subcontinent; †Native American Indians.

molars in digital periapical radiographic images obtained from a Turkish patient.

Materials and Methods

Periapical radiographs of 640 subjects, which had been obtained in the Department of Oral Diagnosis Radiology, Kırıkkale University Dental Faculty, Kırıkkale, Turkey from June 2010 to March 2011, were screened and examined retrospectively. The bilateral eccentric periapical radiographs (30° mesial angulation with protractor) of patients who visited the Department of Restorative Dentistry Endodontics 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 Turkish origin. Demographic details including age, sex, and race of all these patients were recorded. To reduce radiographic misinterpretation, blurred images of teeth were excluded.^[43]

All radiographs were evaluated under optimal conditions using double magnifying glasses. Each radiograph was separately evaluated by two authors (H.Ç. and M.M.H.). If disagreement existed, a joint evaluation of all authors was made until a consensus was reached. The criteria for the indication of an extra root were adopted from recent studies^[6,19,31,32,35] 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 was 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 640 patients, 334 females and 306 males, with age range of 15–72 years and average age of 30.3 ± 12.5 years, were studied. The periapical radiographs of 9 patients, 4 females, and 5 males, had three-

rooted mandibular first molars. A total of 1205 periapical radiographs of mandibular first molars comprising 596 right and 609 left molars were evaluated [Table 2]. Of these three-rooted mandibular first molars, 7 were found on the right side and 5 on the left side. The overall incidence of patients with three-rooted mandibular first molars was 1.41% [Table 2]. The incidence was 1.63% for men and 1.2% for women [Table 2]. The prevalence of three-rooted mandibular first molars from all teeth examined was 1% (12 of 1205), 1.17% (7 of 596) for the right side and 0.82% (5 of 528) 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 ($\chi^2 = 0.21, P > 0.05$) and between the right- and left-side occurrences ($\chi^2 = 0.38, P > 0.05$). The bilateral incidence of symmetrical distribution was 33.3% (3 of 9). The Figures 1 and 2 shows examples of radix entomolaris on formed periapical radiograph

Discussion

Morpho-anatomic changes in teeth may be divided according to the site of their occurrence; i.e., tooth crown, roots, and root canals. Third root anomalies with close similarity inherited by different etiology.^[41] The mechanism of formation of RE 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 polygenic 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.^[21,42] Curzon *et al.* suggested that the “three-rooted molar” trait has a high degree of genetic penetrance as its dominance was reflected in the fact that the prevalence of the trait was similar in both pure Eskimos and Eskimos/Caucasian mixes.^[18]

The reported frequency of three-rooted mandibular first molars is high among the Mongoloids as opposed to the Caucasians and Negroids.^[12,15] It is highest among Eskimos.^[14,18] RE is not very common and, with a maximum frequency of 3.4-4.2%, is considered to be an unusual or dysmorphic root morphology.^[10,22,38] Although many studies

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	334	2	0.60	1	0.30	1	0.30	4	1.20
Male	306	2	0.65	1	0.33	2	0.65	5	1.63
Total patients	640	4	0.63	2	0.31	3	0.47	9	1.41
No. of all right first molars examined	596	4	0.67	-	-	3	0.50	7	1.17
No. of all left first molars examined	609	-	-	2	0.33	3	0.49	5	0.82
Total teeth	1205	4	0.33	2	0.17	6	0.50	12	1.00

have been carried out to explore the prevalence of three-rooted first in different population, there were no published studies in the Turkish population.

In our study, the prevalence of three-rooted permanent first molar in the Turkish population was found to be 1.4% and 0.75% of all teeth examined. This finding is in agreement with a previous report on Europeans and Whites [Table 1] but was considerably lower compared with data reported for non-European races. A detailed comparison of the results obtained in the present study with previous reports can be found in Table 1. In this study, there was no significant difference according to gender ($P > 0.05$), which is similar to the recent studies.^[31-33]

According to the present results, there was not a significant difference between left and right occurrence (left vs. right side, $P = 0.537$). This finding is similar to recent reports on a German and Chinese.^[43] However, other studies reported that three-rooted mandibular first molars occurred more frequently on the right side than on the left side,^[23,31,44] whereas there are also studies showing that these teeth occurred more frequently on the left side.^[28,35] These contradictory findings may be explained by marked differences in the sample size and in the methods used.

We found that the incidence of bilateral permanent three-rooted mandibular molars was 33.3% (3/9 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)^[7,15,31] and which was more than the recent study^[32] among the German population (0%).

Although many studies have been carried out to explore the prevalence of three-rooted first molars, they have differed in methodology.^[6,12,14,15,18,31,32,35,43] In the present study, noninvasive and inexpensive periapical radiographs were used. These periapical radiographs were taken from at least two different horizontal angles (one of these taken in the orthoradial position and the other taken either 30° mesially or distally). This method ensured proper identification of three-rooted mandibular molars. Some previous studies have used extracted teeth^[6,12,13,20,21] to identify permanent three-rooted mandibular first molars, which might have led to an under estimation of their frequency because teeth with slender roots can easily be fractured on extracted teeth. Moreover, but it is impossible to compare the results of these studies related to gender and bilateral occurrences. The recent introduction of cone-beam computed tomography (CBCT) potentially provides dentistry with a practical tool for noninvasive and three-dimensional (3D) reconstruction imaging for use in endodontic applications and morphologic analyses.^[9,10,15,34] The application of CBCT can determine the exact position of the distolingual root of the permanent mandibular first molars.^[32]



Figure 1: Radix entomolaris in mandibular first mola



Figure 2: Radix entomolaris in right mandibular first molar

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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