The Prevalence of Three-rooted Mandibular Permanent First Molars in a German Population

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Abstract

The purpose of this retrospective study was to assess the prevalence of three-rooted mandibular first molars among a German dental school patient population. A total of 800 patients' full-mouth periapical radiographs were screened, and, out of these, 524 patients possessing at least one mandibular first molar were selected. The radiographs of these cases were evaluated under optimal conditions using double magnifying glasses. The incidence of three-rooted mandibular first molars and the correlation between left- and right-side occurrences and between males and females were recorded and analyzed using the chi-square test. A total of 1,024 mandibular first molars were evaluated. Left molars comprised 500 teeth and right molars 524 teeth. Seven patients were found to have a three-rooted mandibular first molar, three females and four males ($p = 0.981$). The overall incidence of patients with three-rooted mandibular first molars was 1.35%. All three-rooted molars occurred unilaterally. The prevalence of teeth showing an extra root from all teeth examined was 0.68%. The right first molar had an incidence of 0.57% and the left molar of 0.80%, respectively ($p = 0.953$). In conclusion, the occurrence of three-rooted mandibular first molars among this German population was rare. *(J Endod 2009;35:202–205)*

Key Words

Accessory root, anatomy, distolingual root, radix entomolaris, radix paramolaris

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0099-2399/$0 - see front matter

doi:10.1016/j.joen.2008.11.010

One of the main objectives of root canal treatment is the thorough chemomechanical shaping and cleaning of the entire root canal system before bacteria-tight obturation. Therefore, a meticulous knowledge of the presence of unusual root canal morphology is imperative for successful root canal treatment (1–6).

Variations in root canal morphology of the mandibular first molar have been frequently reported. In white populations, this tooth usually has two roots, one placed mesially and the other distally (7). The major variant is the occurrence of a third root, which is well documented in the literature (Tables 1 and 2). This supernumerary root, first mentioned by Carabelli (8), is located distolingually and called radix entomolaris (9). In very rare cases, an additional root can occur at the mesiobuccal side and is called radix paramolaris (1, 9, 10). The coronal part of the radix entomolaris is completely or partially fixed to the distal root, and its dimension can vary from short conical extension to a root with normal length and root canal (1). The radix entomolaris, which in general is smaller than the distobuccal and mesial roots, can be separate from or partially fused with these other roots (1, 11). Based on the curvature of the separate radix entomolaris, De Moor et al. (2) have suggested a classification with three different types of radix entomolaris; type I refers to a straight root, type II to an initially curved entrance that continues as a straight root, and type III to an initial curve in the coronal third of the root canal and a second curve beginning in the middle and continuing to the apical third (1, 2).

This additional root has a frequency of less than 4% in whites (UK, Dutch, German, Finnish, and European descents, Table 1) and about 2.8% in African populations (10, 12), whereas in populations with Mongoloid traits (American Indians, Eskimos, and Chinese, Table 2) this additional root occurs with a frequency between 5% and more than 30%. In these populations, the radix entomolaris is considered to be a normal morphologic variant (1) and can be seen as an Asiatic trait (6). It was suggested (13) that the three-rooted mandibular molar has a certain impact as a genetic marker and therefore has a certain anthropologic significance (14, 15). This unusual root morphology seems to have a high degree of genetic penetrance because its dominance was reflected in the fact that Eskimo and Eskimo/white mixes had similar prevalence of this aberration (2, 13).

Although this observation suggests the formation of the radix entomolaris could be related to penetrance of an atavistic gene or polygenetic system (1, 16), the etiology behind this trait is still unclear (1). Besides racial genetic factors, external factors during odontogenesis might also be responsible for supernumerary roots (1).

Although supernumerary roots in mandibular first molars are rare in European populations (Table 1), knowledge of their occurrence and significance in clinical dentistry are important (1, 2) because several case reports on the treatment of three-rooted mandibular first molars in patients of European origin have been reported recently (1, 2, 17, 18). Apart from the well-known endodontic problems associated with a "missed" root canal, an additional root may also be a contributing factor to localized periodontal destruction because greater probing depths and attachment loss at distolingual sites of three-rooted mandibular first molars have been described (19).

The aim of this retrospective study was to evaluate the frequency of the occurrence of three-rooted mandibular first molars in a German dental school patient population using full-mouth periapical radiographs.

Materials and Methods

A total of 800 patients' retrospective full-mouth periapical radiographs, which were already recorded in the Department of Periodontology, University of Münster,

TABLE 1. Survey of Available Studies on the Prevalence of Three-rooted Mandibular First Molars in European Populations

Authors	Year	Population	No. of Teeth	No. of Three-Rooted Molars	
				n	%
Taylor (31)	1899	United Kingdom	119	4	3.4
Bolk (9)	1915	Netherlands	1,713	18	1.1
Fabian (32)	1928	Germany	—	—	1.6
Hjelmman (33)	1929	Finland	—	—	0.9
de Souza-Freitas et al (25)	1971	European descent	844	27	3.2
Curzon [24]	1973	United Kingdom	377	13	3.4
Present study	2006	Germany	1,024	7	0.7

Germany, from August 1983 to February 2008 were screened. Out of these, a total of 524 patients possessing at least one mandibular first molar (1024 first molars) were selected for this study. Each of these patients had to have a full-mouth series of radiographs, had to be at least 18 years of age, and had to be of German origin. Personal details including age, sex, and race of all these patients were recorded.

The full-mouth periapical radiographs were taken using Kodak Ultra-Speed films (Kodak, Stuttgart, Germany). The films were developed, fixed, and dried in an automatic processor (Dürr-Dental XR 24 Nova; Dürr, Bietigheim-Bissingen, Germany). All radiographs were evaluated under optimal conditions using double magnifying glasses. The radiographs were placed on a viewing box, and the light surrounding the radiograph was blocked. Each radiograph was separately evaluated by two authors (DB and SJ). 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 (5, 15, 20, 21), and the presence of an extra root was indicated by the crossing of the translucent lines defining the pulp space and periodontal ligaments. The relative incidence and the correlations between left- and right-side occurrences and between males and females were analyzed by using the chi-square test.

Results

Five hundred twenty-four patients, 260 females and 264 males, aged between 24 and 80 years (average 56.5 ± 14.6 years) were considered in this study. A total of 1,024 mandibular first molars were evaluated. Left molars comprised 500 teeth and right molars 524 teeth (Table 3). Seven patients were found to have a three-rooted mandibular first molar, three females and four males ($p = 0.981$). The overall incidence of patients with three-rooted mandibular first molars was 1.35% (Table 3). The incidence was 1.52% for men and 1.15% for women (Table 1). All three-rooted molars occurred unilaterally.

The prevalence of teeth showing an extra root from all teeth examined was 0.68%. The right first molar had an incidence of 0.57% and the left molar of 0.80%, respectively (Table 3, $p = 0.953$).

Discussion

According to the present results, the occurrence of three-rooted mandibular first molars in a German population was 1.35% of all patients and 0.68% of all teeth examined, respectively. This finding is in agreement with a previous report on Europeans (Table 1) but was considerably lower compared with data reported for non-European

TABLE 2. Survey of Available Studies on the Prevalence of Three-rooted Mandibular First Molars in Patients of Non-European Origin

Population	Authors	Year	No. of Teeth	No. of Three-Rooted Molars	
				n	%
White	Skidmore and Bjomdahl (34)	1971	45	1	2.2
	Ferraz and Pécora (12)	1992	117	5	4.2
Chinese	Tratman (14)	1938	1615	95	5.8
	Yew and Chan (6)	1993	832	179	21.5
	Jones (29)	1980	52	7	13.4
	Huang et al (19)	2007	332	11	21.7
Eurasian	Tratman (14)	1938	282	11	4.2
Eskimo, Aleut	Turner (35)	1971	263	84	32.0
Keewatin	Curzon and Curzon (26)	1971	98	28	27.0
Baffin	Curzon (13)	1974	69	15	21.7
Hong Kong Chinese	Walker and Quackenbush (20)	1985	213	31	14.6
	Walker (15)	1988	100	15	15.0
Indians					
American	Turner (35)	1971	1983	116	5.8
Canadian	Somogyl-Csizmazia and Simons (30)	1971	250	39	15.6
Japanese	Tratman (14)	1938	168	2	1.2
	de Souza-Freitas et al (25)	1971	233	83	17.8
	Harada et al (36)	1969	2331	440	18.8
	Ferraz and Pécora (12)	1992	105	12	11.4
Malaysian	Tratman (14)	1938	475	41	8.6
	Laband (37)	1941	134	11	8.2
	Jones (29)	1980	149	25	16.0
Singaporean Chinese	Loh (28)	1990	304	24	7.9
Taiwanese	Tu et al (5)	2007	332	59	17.8
Thai	Reichart and Metah (16)	1981	364	70	19.2
	Gulablvala et al (4)	2002	118	15	12.7