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Research Article

Prevalence of Four Canals in Mandibular First Molars in Libyan Sub-population: An *InVivo* Study

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ABSTRACT

The aim of this in vivo study was to assess the prevalence of four root canals in root-treated mandibular first molars in Libyan population. One eighty-five root canal treated permanent mandibular first molars was selected. The teeth were examined clinically and radio graphically. The results showed that 73.0% of the examined teeth had three root canals (two mesial and one distal), 26.5% had four root canals (two mesial and two distal) and 0.5% had five root canals (three mesial and two distal). Most of teeth had two roots (2.16%), except three teeth of males (3.16%) had three roots and one tooth of female had three roots (1.11%). Therefore, the conclusion is that the prevalence of four root canals in mandibular first molar is greater, almost one quarter in this sample of Libyan population.

Keywords: Mandibular 1st molar; Root canals; Root canal morphology

INTRODUCTION

The ultimate aim of the endodontic treatment is that the process of a thorough debridement and obturation of the entire root canal method in root canal treatment. This will help the practitioner successfully eliminate the entire pulp tissue remains during treatment. Furthermore, understanding of the nature of abnormal morphology of the root canal will contribute to the positive root canal treatment outcome [1].

Regarding the morphology of the root canal, prior studies reports that the tooth usually has 2 roots, nonetheless sometimes it has 3, with two or three canals in the mesial root and one, two or three canals in the distal root. The two canals in the mesial or distal root are frequently connected [2]. Furthermore, the first mandibular molar is known to be able to show numerous structural differences. Majority of the first molars have two mesial canals and one distal canal [3,4]. The mesial root has two root canals in most cases, terminating in two distinct apical foramina or sometimes, these merge together at the root tip to end in one foramen. Furthermore, the distal root usually has one kidney-shaped root canal, even though if the orifice is particularly narrow and round, a second distal canal may be present. In the first mandibular molar, several anatomical variations stated the presence of three mesial canals [5,6] and three distal canals [7]. Like the number of root canals, there may also vary the number of roots. An additional third root of the main distal root can be found lingually or buccally. It is called the radix entomolaris if it lies lingually, and the additional root at the mesiobuccal side is called the radix paramolaris [8,9]. Since the incidence of four root canals in the mandibular first molar in different countries has been reported in most endodontic manuals, the incidence among Libyan population needs to be known. Hence, the purpose of this study is to investigate the pervasiveness of four root canals in the permanent mandibular first molars of Libyan population. Therefore, finding all root canals will permit the practitioner to eradicate all pulp tissue debris effectively during treatment. Null hypothesis is that there is no difference in number of root canals in mandibular first molars.

MATERIALS AND METHODS

A total of 185 root canal mandibular first molars were examined. Ninety-five teeth were of male patients and ninety-four teeth were of female patients. These patients have been cured under an endodontist's strict observation. The endodontist accurately evaluated the morphology and the canal orifice recognition after gaining cavity preparation and elimination of coronal pulp from each tooth. The radiographic images taken at various positions throughout working length determination and subsequently after obturation of the canals of each tooth were fixed, estimated, and calculated. Two examiners examined the entire radiographs. Therefore, the medical reports were checked and the results for each individual patient were then arranged and reported in an

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extraordinary form. Moreover, roots with multiple canal systems were classified either by a communal apical foramen or by single apical foramina. All the teeth observed had no root resorption, no calcification of the channel, open apices, broken tool, and no past root canal treatment.

Inclusion criteria

1. Adult Libyan citizens who live in Libya

2. Mentally and physically healthy adult participants

Exclusion criteria

The included teeth in the examination must be vital teeth without root canal treatment or coronal restoration or any kind of crowns that may obscure the x-ray image. Furthermore, teeth must be excluded if there is root resorption, canal calcification, open apices, broken instruments, or any prior root canal therapy.

RESULTS

Statistical analysis

Descriptive analysis showed that out of 185-root canal treated mandibular first molar teeth in this study, 26.5% had four canals, 73.0% had three root canals and 0.5% had five canals. All mesial roots had two root canals but one tooth which is for female patient, so this tooth had five canals, and represents 0.5% of our study. The fourth canal is usually located in the distal base, except for the five-canal tooth for the female patient. Most of the teeth had two roots apart from three teeth for males 3.16% and one tooth for females 1.11% (Tables 1 and 2).

Table 1: Analysis and distribution of canals per root. One male patient with two teeth.

Sex	No of patients	No of teeth	Number of canals/teeth					
			3%		4%		5%	
Male	94*	95	69	37.3	26	14.1	0	0
Female	90	94	66	35.7	23	12.4	1	0.5
Total	184	185	135	73.0	49	26.5	1	0.5

Table 2: Analysis and distribution of roots per tooth.

Sex	No of teeth	No of roots/tooth			
		2%		3%	
Male	95	92	96.84	3	3.16
Female	90	89	98.89	1	1.11
Total	185	181	97.84	4	2.16

Although there is no difference between males and females regarding the distribution of canals in the mesial roots, there is a noteworthy difference between males and females in the distribution of canals in the distal roots. The percentage of joined canals at the apical foramen in distal root for female patients is 60.87% which is higher than their counterparts' males 23.81%. Whereas, the percentage of separate canals at the apical foramen in distal root for male patients is 62.89% which is higher than their counterparts' females 39.13% (Tables 3 and 4).

Table 3: Analysis and distribution of the two canals in each root of male patients.

Root	Apical foramen		
	Joined%	Separate%	Total number
Mesial	36 37.11	61 62.89	97
Distal	5 23.81	16 76.19	21

Table 4: Analysis and distribution of the two canals in each root of female patients.

Root	Apical foramen		
	Joined%	Separate%	Total number
Mesial	36 41.38	51 58.62	87
Distal	14 60.87	9 39.13	23

DISCUSSION

Using radiographic techniques to study the root canal system morphology may seem to have some drawbacks. The clinician can only see the tooth in a two-dimensional image, and the X-ray can conceivably miss extra root channels. Nonetheless, clinical analysis (*in vivo*) remains the only non-invasive method available and can be resolved by taking radiographs at different angles of the same tooth from a two-dimensional perspective. Therefore, by conforming to the radiographic standard for evaluating the quantity of roots and root canals, this study divulges that in all cases traditional definition of the first mandibular molar having three canals in its two roots is incorrect concept in altogether cases.

In this study, we establish that 26.5% of the teeth were identified with four canals, and (73.0%) of the teeth with three canals and only 0.5% of teeth with 5 canals. The results of our study are in line by these formerly stated studies [10-14]. Furthermore, the mesial root usually contains two fine, narrow channels (mesio-buccal and mesio-lingual). In this study, we found one tooth of a female patient that having three canals in the mesial root (0.5%), named mesio-buccal, mesio-lingual and middle mesial, this finding agrees with the results of previous studies by Vertucci et al. and Martinez-Berna et al. [15,16].

Regarding the distal root, generally, the distal root has a large canal that tapers gradually to the apex. Fabra-Campos reported a significant difference in the number of canals in the distal root and Walker reported two canals with up to 47.6%; however, the percentage in our study is almost half of that (26.5%) [17]. When we compare of the findings of our study with previous studies, we found our result in line with Bangladeshi study in 2014 that the percentage of the incidence of four root canals in the Libyan population tends to be lower than the percentage of prevalence of three canals.

In 1971, Skidmore and Bjorndal examined first molar teeth extracted from the mandibular and reported that 59.5% of mesial root and 38.5% of distal roots had separate apical foramina [18,19]. Furthermore, Zaatar et al. [14] found that 43.3% of the mesial root and 16.8% of the distal roots had separate apical foramina. The results of the existing study are greater for the distal canal but lesser for the mesial canal than that stated by Skidmore et al.

The variations perceived in this study compared to those mentioned in Tables 1-4 suggest that disparities linked to genetically determined differences which have a relation to racial background of patients.

CONCLUSION

This study's findings are very significant to help the practitioner

have satisfactory information about the root canal morphology of this country's bulk population and about potential morphological differences. Given the greater incidence of a fourth channel in the distal root of the first mandibular molar, the clinician will be directed to scan for such additional channel. Therefore, practitioner will develop the skills required to find, clean and reshape the entire root canal system and initiate higher rates of successful endodontic treatment.

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