

## Original Article

# “Incidence of four canals in root-canal-treated mandibular first molars in Bangladeshi population”

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### Abstracts:

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The aim of this in-vivo study was to assess the incidence of four root canals in clinical cases of root-treated mandibular first molars in Bangladeshi population. A clinical study of 135 root canal treated permanent mandibular first molars was conducted. The teeth were examined clinically and radiographically. The results showed that 52.59% of the examined teeth had three root canals (two mesial and one distal), 45.92% had four root canals (two mesial and two distal) and 0.0148% had five root canals (three mesial and two distal). All the teeth had two roots and no three rooted mandibular first molar found. So it can be concluded that the occurrence of three root canals in mandibular first molar is higher but four root canals is also high in Bangladeshi population.

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### Introductions:

In root canal treatment, complete debridement and obturation of the entire root canal system is considered to be the main objective of the therapy. Thus, locating all root canals will allow the clinician to remove successfully all pulp tissue debris during treatment.<sup>1</sup>

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The earliest permanent posterior tooth to erupt, the mandibular first molar seems to be the tooth that most often requires root canal treatment. It often is extensively restored, and it is subjected to heavy occlusal stress. Regarding the root canal morphology, previous in vitro and in vivo reports have indicated that the tooth usually has two roots, but occasionally it has three, 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 often interconnected.

Several methodologies have been used to study the root canal system configuration of the first mandibular molar. They include plastic resin injection, endodontic access and radiographs with files into root canals, retrospective evaluation of radiographs, clearing of samples with or without ink injection, sectioning and macroscopic or scanning electron microscopy (SEM) evaluation, computed tomography (CT), spiral computed tomography (SCT), micro-computed tomography (mCT), and cone-beam computed tomography (CBCT)<sup>2</sup>. Although many modernized methodologies have been

introduced for studying root canal system, and also the use of radiographic techniques might appear to have certain disadvantages, this method is still the most reliable and popular method in clinical sitting.

Although the incidence in different countries of four root canals in the mandibular first molar has been reported in most endodontic textbooks, there is a need to know the incidence among the Bangladeshi population. Therefore, the purpose of this investigation was to study the prevalence of four root canals in the permanent mandibular first molars of Bangladeshi population.

**Materials and Methods:**

A total of 135 root canal treated mandibular first molars were studied. The teeth were randomly selected. Seventy three were from male and sixty two were from female patients. These patients were treated under strict supervision of an endodontist. After access cavity preparation and removal of coronal pulp of each tooth the floor morphology and the canal orifice identification were properly evaluated by an endodontist. The radiographic films taken at different angles during working length

determination and after obturation of the canals of each tooth were mounted, projected and evaluated. All radiographs were viewed by two examiners. In addition, the clinical records were reviewed and the findings were then tabulated and recorded on a special form for each individual patient. Roots with multiple canal systems were categorized according to whether the canals exited the root by a common apical foramen or by separate apical foramina. All the examined teeth were free of root resorption, had no canal calcification, open apices, broken instrument and no previous root canal therapy.

**Results:**

Of the 135 root canal treated mandibular first molar teeth in this study, 45.92% had four canals, 52.59% had three root canals and 0.0148% had five canals (Table 2). All mesial roots had two root canals except two teeth, one in male and one in female patient, those had three canals in the mesial roots and two canals in distal roots, so these two teeth had five canals in each tooth. Except these two teeth the fourth canal was

usually located in the distal root. All teeth had two roots and no three rooted mandibular first molar was found. The two root canals in the mesial and distal roots were mostly confluent in the apical third, ending in one foramen (Table 3 and 4). There was no significant difference between males and females in the distribution of the root canals (P>0.05).

**Table: 1 Analysis and distribution of canals per tooth.**

Sex	No of teeth	No of canals/tooth					
		3	%	4	%	5	%
Male	73	39	53.42	33	45.21	1	0.01
Female	62	32	51.61	29	46.77	1	0.02
Total	135	71	52.59	62	45.92	2	0.0148

Table: 2 Analysis and distribution of the two canals in each root of male patient (n=73).

Root	Connection between canals				Total
	Joined	%	Separated	%	
Mesial	42	57.53	31	42.47	73
Distal	21	61.76	13	38.23	34

Table: 3 Analysis and distribution of the two canals in each root of female patient (n=62).

Root	Connection between canals				Total
	Joined	%	Separated	%	
Mesial	36	58.06	26	41.94	62
Distal	17	56.67	13	43.33	30

### Discussions:

The use of radiographic techniques to study the morphology of the root canal system might appear to have certain disadvantages. The operator can only see the tooth in a two-dimensional image, and conceivably extra root canals can be missed on the radiograph. However, clinical examination (in vivo) remains the only noninvasive method available and the missing of canal in a two dimensional view can make overcome by taking radiograph in different angle of the same tooth. Therefore, and by strictly adhering to the radiographic criteria for determining the number of roots and root canals, this study reveals that the conventional concept of mandibular first molar have three canals in its two roots is not correct in all cases. In this study 45.92% teeth found with four canals, though it is not higher than the incidence of three canals (52.59%), but the difference was not so great. The findings of this study were in good accordance with the previously reported studies.<sup>3,4,5,6,7,8</sup>

Two fine, narrow canals (mesio-buccal and mesio-lingual) are usually present in the mesial root. They are discrete entities or possess a multiplicity of anastomoses and corridors connecting the two root canals as they proceed apically. In this study two teeth found having three canals in the mesial root (0.0148%), named mesio-buccal, mesio-lingual and middle mesial. The possibility of three root canals in the mesial root was also reported by Vertucci & Williams in 1974, Fabra-Campos in 1985 and Martinex-Berna & Badanelli in 1985.<sup>6,9,10</sup>

The distal root generally present one wide canal that tapers evenly to the apex. A great variance in the number of canals in the distal root has been reported by Fabra-Campos in 1985 and Walker in 1988 with up to 47.6% having two canals which is very much similar with the finding of this study (45.92%).<sup>6,11</sup>

Few reports have indicated three canals in the distal root (Reichart & Metah 1981, Stroner et

al. 1984)<sup>12,13,14</sup>. But in our observation we did not find any tooth with three canals in distal root.<sup>12,13</sup>

A comparison of the findings of this study with previous investigations reinforces the view that the incidence of four root canals in the Bangladeshi population appears to be high, but not higher than the incidence of three canals.

Skidmore & Bjorndal in 1971 examined extracted mandibular first molar teeth and reported 59.5% of mesial root and 38.5% of the distal roots had separate apical foramina.<sup>14</sup> In addition, Zaatar *et al.* in 1997 found 43.3% of

the mesial root and 16.8% of the distal roots has separate apical foramina.<sup>8</sup> The findings of the present study are higher for the distal canal but lower for the mesial canal than that reported by Skidmore & Bjorndal and Zaatar *et al.*

The differences seen in the present study compared with those listed in Table 1 indicate that there may be genetically determined differences related to racial background. In addition, the presence of four root canals was reported to be more common in root canal treated teeth than in those which have been studied *in vitro*.<sup>6,15,16</sup>

**Table 4: Incidence of mandibular first molars with four canals using different methods**

Author/year	No. of teeth	Percentage of four canals	Methods used
Hess 1925	512	4.0	Vulcanite cast of extracted teeth ( <i>in vitro</i> )
Griffin <i>et al.</i> 1969	203	27.5	Radiographs of endodontically treated teeth ( <i>in vitro</i> )
Skidmore & Bjorndal 1971	45	28.9	Polyester casting resin of extracted teeth ( <i>in vitro</i> )
Pineda & Kuttler 1972	300	27.0	Radiographs of extracted teeth ( <i>in vitro</i> )
Vertucci & Williams 1974	100	30.0	Extracted teeth ( <i>in vitro</i> )
Vande Voorde <i>et al.</i> 1975	136	31.0	Radiographs of endodontically treated teeth ( <i>in vivo</i> )
Hartwell & Bellizzi 1982	846	35.1	Radiographs of endodontically treated teeth ( <i>in vivo</i> )
Fabra-Campos 1985	145	47.6	Radiographs of endodontically treated teeth ( <i>in vivo</i> )
Walker 1988	100	45.0	Radiographic and visual (clearing) of extracted teeth ( <i>in vitro</i> )
Yew & Chan 1993	832	31.5	Radiographic and visual (clearing) of extracted teeth ( <i>in vitro</i> )
Zaatar <i>et al.</i> 1997	147	29.9	Radiographs of endodontically treated teeth ( <i>in vivo</i> )

## Conclusions:

The findings of this study are very important in assisting the dentist to provide adequate knowledge about the root canal morphology of the majority population of this country and about the possible morphological variations. Keeping in mind about the higher incidence of a fourth canal in distal root of mandibular first molar, will guide the operator for searching such additional canal. Thus, clinicians will develop skills necessary to locate, clean and shape the entire root canal system and will lead to higher level of endodontic success.

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