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ORIGINAL RESEARCH ARTICLE

PRESENCE OF EXTRA CANAL IN PERMANENT MANDIBULAR FIRST MOLAR

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ABSTRACT

Background: The success of root canal therapy depends on proper knowledge of root canal system, presence of extra canals, complete debridement and three-dimensional obturation of the entire root canal system. Previous studies have reported three to five canals in mandibular first molars. There might be chance of missing the canal that may lead to root canal failure, because of the variability in the number of root canals. The objective of this study was to determine the percentage of extra canal in the permanent mandibular first molar in patients undergoing root canal treatment.

Methods: This cross-sectional study was conducted in the Department of Conservative Dentistry and Endodontics of Peoples Dental College and Hospital over a period of ten months from 6th September 2021 to 31st July 2022 after receiving ethical clearance from Institutional review Committee (IRC) Peoples dental college on 5th September 2021 (ref no1/ch no 5,2078/2079). About 350 mandibular first molar was selected by convenient sampling. After access preparation, all canal orifices were located and data were recorded. Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 22.0 with frequency table.

Results: Out of 350 patients, the percentage of three canals, four canals and five canals were respectively 273(78%), 76(21.7%) and 1(0.3%).

Conclusions: The finding of this study supports the presence of extra canals in mandibular first molar. Thus, the clinicians require more diagnostic approaches, access modifications, and skills to locate, clean and shape the entire root canal system.

INTRODUCTION

Mandibular first molar is the first permanent molar to erupt in the oral cavity. The mandibular first molars are subjected to heavy occlusal load, extensively restored, and frequently root canal treated tooth in the oral cavity. [1]

The success of root canal therapy depends on having proper knowledge of root canal system, knowledge about the presence of extra canals, complete debridement and three-dimensional obturation of the entire root canal system. Despite the meticulous procedure there might be the chance of failure of root canal therapy due to the persistent microorganism present because of missed canals and leaving it untreated.[2] Thus, locating all root canals will allow the clinician to successfully remove all pulp tissue debris and microorganisms during treatment.

In regards to the canal configuration, mandibular first molar generally has two roots and three canals. However, presence of extra canal and extra root is also not unusual. The mandibular first molar has a wide variety of root canal configurations.[3]

Therefore, this study was conducted to determine the percentage of extra canal in the permanent mandibular first molar and to compare the result between male and female. Thus, the study will help to gain knowledge regarding the percentage of extra canals in the permanent mandibular first molar.

METHODS

A cross-sectional study was conducted over a period of ten months from 6th September 2021 to 31st July 2022 in the Department of Conservative Dentistry and Endodontics of People's Dental College and Hospital after receiving ethical clearance from Institutional review Committee (IRC) Peoples dental college on 5th September 2021 (ref no1/ch no 5, 2078/2079). Convenience sampling was done. Sample size was calculated, by taking the required parameters from reference article by Nisha et al.[3] as,

$$n = z^2pq / d^2$$
$$= (1.96)^2 * (55.9) * (44.1) / (5.59)^2$$
$$= 304$$

Where,
n= sample size
z= 1.96 at 95% Confidence interval level
p= prevalence of extra canal from previous study, 55.9%
q= 100-p = 44.1%
d= maximum tolerable error, 10% of p, i.e., 5.59 %

Taking 10% as non-response error, total sample size was, n= 304 + (10% of 304) =334.4. However, in this study 350 samples were taken.

Patient between the age of 20 to 65 years who had been diagnosed with pulpal or periapical disease in any of the mandibular first molar, and could be endodontically salvaged were included in the study. Informed written consent was taken for all the participants. Pregnant female, grossly decayed tooth, tooth with orthodontic braces, crown restoration and requiring retreatment was excluded from the study. Preoperative radiographs were taken for evaluation of root morphology, number of canals and periapical status. Teeth with calcified pulp chamber and root canals, root resorption and anyone not willing to participate in the study were excluded.

In this study, 2% lidocaine with adrenaline 1:80000 was used for inferior alveolar nerve block. Isolation was done using rubber dam. An access cavity was prepared using endo access and endo Z bur in a high-speed handpiece with copious water spray. Copious irrigation was done using 2.5% sodium hypochlorite and normal saline to remove the debris and remaining pulp tissue. Then identification of all root canal orifices with sharp endodontic explorer (DG16 EndoExplorer, Hu-Friedy, United States) was done. Then search of any extra canal was performed in dry and clear field along the dentinal map using illumination (Softtouch, Eighteeth, China) and dental loupe of 3X magnification (Brilliance, Eighteeth, China). Endodontic ultrasonic tip (E15D, NSK, Japan) was used to locate the extra canal. Then, all the root canals were negotiated with small stainless steel (ISO size 08 and 10) hand K-files. Digital Radio-Visio graph (RVG) was taken using Clark's techniques for visualizing all canals separately. Then number of root canals was recorded in proforma. In subsequent visits, root canal treatment was completed.

Data collected was entered in Microsoft Office Excel. Statistical analysis was done using Statistical Package for Social Sciences for Windows, version 22.0 (IBM Corp., Armonk, N.Y., USA).

RESULTS

Among 350 patients undergoing endodontic therapy, 157(44.9%) were male and 193(55.1%) were female; 175(50%) left and 175(50%) right mandibular first molar teeth. Among the subjects, 338(96.6%) had 2 roots, whereas 12(3.4%) of the subjects had 3 roots.

On studying the number of canals, the percentage of three canals, four canals and five canals were found in 273(78%), 76(21.7%) and 1(0.3%) respectively (Table1).

Table 1: Demographic parameters

Parameters	Frequency (%)
Male	157(44.9)
Female	193(55.1)
Left molar (36)	175(50)
Right molar (46)	175(50)
2 roots	338(96.6)
3 roots	12(3.4)
3 canals	273(78.0)
4 canals	76(21.7)
5 canals	1(0.3)

The number of three canals in male is 127(46.5%) and female is 146(53.5%). Similarly, the number of four canals in male is 30(39.5%) and in female is 46(60.5%). There was only one case of five canals in female (Table 2). The comparison of the number of canals between gender were not significant (p=.366).

Table 2: Comparison of number of canals between male and female

Category	3 canals	4 canals	5 canals	p-value
Male	127(46.5%)	30(39.5%)	0(0%)	0.366
Female	146(53.5%)	46 (60.5%)	1(100%)	

Among 175 left first molar, there were 150(85.7%) of three canals, 24(13.7%) of four canals and 1(0.5%) of five canals. Similarly, among 175 right first molar, there were 123(70.3%) of three canals and 52(29.7%) of four canals (Table 3). The difference in number of canals between left and right molars was statistically significant (p=0.001).

Table 3: Comparison of occurrence of extra canal between teeth

Tooth	3 canals	4 canals	5 canals	p value
36	150(85.7%)	24(13.7%)	1(0.5%)	0.001
46	123(70.3%)	52(29.7%)	0(0%)	

DISCUSSION

Root canal system is a complex anatomy. Missed canals and incompletely debrided canals are one of the major causes of root canal treatment failure.[4] Therefore, to provide a successful treatment outcome, the thorough understanding of the complexity and morphologic variation of the root canal system is required before starting the treatment.[5] Missed canals and incomplete debridement provide a space for microorganisms to grow, which causes the persistence of apical periodontitis.[6] Hence, in this study, careful exploration of the pulp chamber was done under magnification and illumination using dental loupes (3X magnification). Magnification and illumination improve incidence of locating extra canals.[7] It also increases visual acuity and operator posture, which also aid in locating extra canals.[7] The ultrasonic tips are used for access refinement, removing pulp stones, locating orifice of calcified canals, and locating extra canals.[8] Moreover, it also helps in

pulp debridement.[8]

Mandibular first molar usually has two roots, mesial and distal. Although two or more root canals are found to be present in mesial root,[9] and distal root has also shown incidence of two canals,[9] the radiograph which usually is taken from bucco-lingual plane may reveal as a single canal. Hence, in this clinical study, digital intraoral periapical radiograph (RVG) was done in different angulation. This helps in revealing more canals in bucco-lingual plane, if present.

The result of this study showed 96.6% of two rooted and 3.4% of three rooted mandibular first molar. The result is in accordance with the study done by Ahmed et al.,[10] Peiris et al.,[11] Al-Qudah et al.[12] However, studies of Huang et al., Song et al. show higher incidence of three rooted mandibular fist molar than our study.[13,14] The variation in this finding might be contributed to the ethnicity.

In this research, incidence of three canals 78% is higher than four canals 21.7%. The incidence of four canals in study is in accordance with the study of Rocha et al.[15] The higher incidence of three canals in this study is in accordance to the study of de Pablo et al. and Rocha et al. [9,15] However, in the study done by Nisha et al. in Nepalese population found higher incidence of four canals 55.9% than three canals 44.1%, which contrasts with this study.[3] This might be because of the difference in number of sample size and also the study population taken from a particular area during sample collection.

Moreover, there were the higher incidence of four canals in a study done by Al-Nazhan on Saudi Arabian sub-population 57.76%,[16] in a study done by Ahmed et al. in Sudanese population 59%,[10] and in a study done by Khan A. et al in Bangladeshi population 45.92%.[1] These all results contrasts with our study.

In this study 0.3% of middle mesial canal were found which is in accordance with the study done by Furri et al. 0.4%.[17] In contrast to this result, the study done by Al-Qudah et al.[12] and Gulavibala et al.[18] showed higher incidence of middle mesial canal.

The result of this study showed high incidence of extra canal in female than in male. However, the result of extra canal between gender was not statistically significant. This finding is in accordance with the study done by Nisha et al.[3]

The variations in findings in root canal of mandibular first molar is anthropological as well as also determined by methods utilized to evaluate the morphology. The recent use of diagnostic tool as cone-beam computed tomography (CBCT) and magnifying and illuminating tool as dental operating microscope (DOM) have served for finding the extra canals more precisely. However, in our study we did not use any of the above-mentioned tools, which remains the limitation of our study.

CONCLUSION

The findings of this study show the presence of extra canal in mandibular first molar. Before starting the root canal procedure, operator must have knowledge about the root canal morphology, its variations, higher incidence of extra canal by proper evaluation with diagnostic radiograph. Thus, clinicians should develop necessary skill to locate, clean and shape the entire root canal system and in addition to this, if clinician suspect the presence of extra canal and has difficulty in locating it, then we can recommend CBCT along with the use of DOM.

CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

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