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Research Article

Study of Root Canal Configuration in Mandibular First Molar: A Cross-sectional Study

Dr. Mohamad Arshid Khanday[1*], Dr. Nazia Lone[2], Dr Anisa Nabi[3], Dr. Mohsin Sidiq[4]

[1] Consultant Pedodontist & Ex Registrar– Department of Pedodontics and Preventive Dentistry Govt Dental College and Hospital Srinagar, India
[2] Professor and H.O.D – Department of Pedodontics and Preventive Dentistry Govt Dental College and Hospital Srinagar, India
[3]Ex. Resident–Department of Oral Medicine and Radiology Govt Dental College and Hospital Srinagar, India
[4] Associate Professor-Department of Pedodontics and Preventive Dentistry Govt Dental College and Hospital Srinagar, India

Corresponding Author:

Dr. Mohamad Arshid Khanday
***Consultant Pedodontist** & Ex Registrar– Department of Pedodontics and Preventive Dentistry Govt Dental College and HospitalSrinagar, India.*

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ABSTRACT

The aim of this study was to clinically evaluate the prevalence of permanent mandibular first molars with three roots among Kashmiri (North Indian) population.Materials and Methods: 356 mandibular first permanent molars from 155 males and 181 females indicated for root canal treatment at the department of Pedodontics and Preventve Dentistry Government Dental College and Hospital Srinagar (Jammu and Kashmir) between febuary 2015- febuary 2016 were screened for radix entamolaris (RE) using periapical radiographs. The prevalence of a third root and the comparison of occurrence between males and females and between the right and left sides of the mandible were recorded using Pearson chi-square testwith significant level set at $p<0.05$.Results: 37 patients were found to have RE with an overall prevalence of 11%. The incidence was 11.6% for females and 10.3% for males. There was statistically no significant difference in the prevalence of three rooted mandibular first permanent molars between males and females ($p= 0.709$). The prevalence of RE from the total teeth examined was 10.4%. The prevalence was 10.5% on right side and 10.2% on the left side. The difference between the right and left side was statistically non-significant ($p=0.944$). In conclusion the practicing dentists especially the pedodontists and endodontists should be familiar with the ethnic variations in root morphology so as to reduce failures caused by missed canals and roots while treating the mandibular molars. This data regarding the prevalence of RE in Kashmiri population, a North Indian state will provide a useful information to the clinicians to achieve a successful endodontic treatment.

***Keywords**: Radix entamolaris, Kashmiri population, Three rooted mandibular molars.*

INTRODUCTION

The primary objective of root canal therapy i.e. proper cleaning and shaping followed by three dimensional obturation largely depends on the familiarity of the clinician with the complexion of the root canal system.[1] One of the frequent causes for the failure of root canal treatment in molars is the inability to identify and negotiation of additional rootsor canals. The mandibular first permanent molar is the earliest permanent posterior tooth to erupt in the oral cavity and is considered to be the most frequently involved tooth in endodontic procedure.[2]Thus the awareness and understanding of the root canal anatomy of mandibular molars is very essential for the clinician to achieve a successful endodontic outcome.

Most of the permanent molars in mandible have two roots (mesial and distal) with three to four root canals The mesial root has two root canals(mesiobuccal and mesiolingual) whereas distal root has mostly one root canal but second root canal can also be sometimes present in distal root.[3]Mandibular molars displays considerable anatomic variations and abnormalities regarding the number of roots and canal configuration[4,5]One of the major anatomical variation is the presence of an additional third root also called as radix entamolaris(RE) which is located distolingually and in very rare cases when this additional root is located mesiobucally, it is called as radix paramolaris (RP).[6] RE/RP can be found in

first, second and third mandibular molars, occurring least frequently in second molars.[7]This major anatomic variation was first identified by Carabelli in 1844.[7] The term RE was coined by MichalyLenhossek in 1922, while as RP also known as mesiobuccal root was first described by Bolk in 1915.[8] This additional root is typically smaller than the mesial and distal roots and is usually curved, requiring special attention when endodontic intervention is considered.[2,4]

The formation of RE/RP is generally related to racial, genetic and external factors during odontogenesis.[9]Many studies have shown varied prevalence of three rooted mandibular first molars in different population groups. The prevalence appears to be 3.4-4.2% in Europeans, [10] 3% in Africans, [11]1.35% in Germans,[12] less than 5% in Eurasians and Indians, [13] 5-40% in Mongoloid traits such as Chinese, Eskimos and American Indians [8]and 8.2% in Malaysians.[14]In the present global perspective when mobilization of various ethnic groups to various parts of the world is more common than earlier, the dentist should be aware of such racial anatomic variationswhen diagnosing and managing endodontic patients because he/she may see the patients of diverse ethnicity daily.No study, so far has been conducted on the prevalence of RE in Jammu and Kashmir population, a North Indian state. Hence the purpose of this study was to evaluate the incidence of permanent mandibular first molars with three roots in Kashmiri population. The study also aimed at assessing any gender predilections along with side (right or left) predominance.

METHODOLOGY

336 patients comprising of 155 males and 181 females with the age group of 9-14 years scheduled for root canal treatment at the department of Pedodontics and Preventive Dentistry Government Dental College Srinagir between febuary 2015- febuary 2016 were included in this clinical investigation. The study was approved by the Research development and sustenance committee of the college. Out of 336 patients 20 needed bilateral root canal treatment. So, a total of 356 periapical radiographs of mandibular first permanent molars comprising of 190 right and 166 left were evaluated for RE. After explaining the proposed treatment and its criteria for evaluation the written consent was taken from all the parents/guardians. The criteria for subject selection were the following:

a) Subject had to be from the Kashmir valley
b) Each subject had fully erupted permanent mandibular first molar indicated for root canal treatment.
c) The permanent mandibular first molar had fully formed apices, no root canal fillings, posts or crown restorations.

Two periapical radiographs were taken from different horizontal angles for each tooth undergoing root canal treatment on Kodak ultra-speed films(Eastman Kodak ultra-speed film, Kodak Rochester, NY, USA) using dental x ray machine(Endos AC, Villa Sistemi Medical S.P.A.,Italy). The radiographs were separately inspected by two pedodontists after placing them over a viewing box using magnifying glasses (2X). Any disagreement between the two observers was jointly discussed until a consensus was reached. The criteria used to indicate the presence of RE was clear distinction of an extra root, indicated by the crossing of translucent line defining the pulp space and periodontal ligament, originating in the upper half of the distal root.[15, 16]

After obtaining adequate anesthesia the tooth was isolated with rubber dam. Conventional root canal treatment was started and trapezoidal access preparation was done with endoacess (Eo 123) and Endo z bur (DentsplayMaillefer, BallaiguesSwitzerland) Figure1. The pulp chamber was irrigatedwith 2.5% sodium hypochlorite and carefully examined with an endodontic probe (DG-16, Dentsply, Glouchester UK). Initial negotiation was done by using precurved K file ISO number 10 (DentsplayMaillefer, Ballaigues Switzerland).Working length was estimated using an apex locator (Root Zx Morita Mfg Corp Kyoto Japan) and confirmed with radiography (Figure 2).

The canals were initially instrumented to a size no.15 K file under copius irrigation with 2.5% sodium hypochlorite. Canal preparation was performed using the crown down technique with manual protaper instrument in all the four cases (DentsplayMaillefer, Switzerland). All the canals were obturated using lateral condensation technique and AH plussealer (De Trey Dentsply, Germany). A postoperative radiograph was taken to assess the technical quality of root canal filling and when satisfactory, apermanent filling was placed.

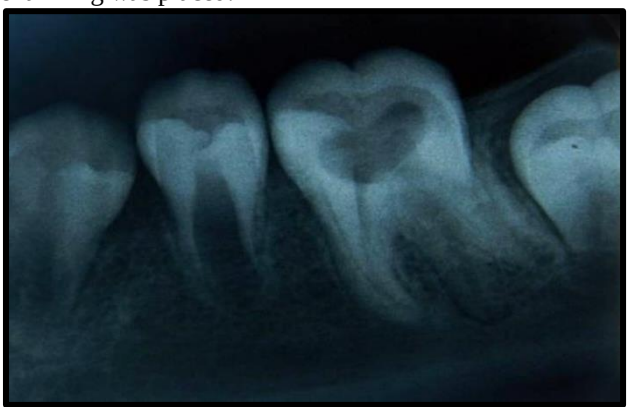

Figure 1: Diagnostic radiograph

Figure 2: Access cavity preparation

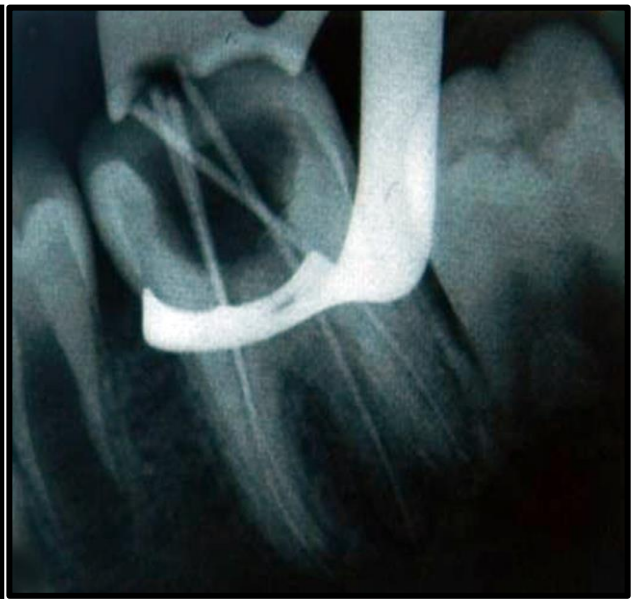

Figure 3: Working length determination

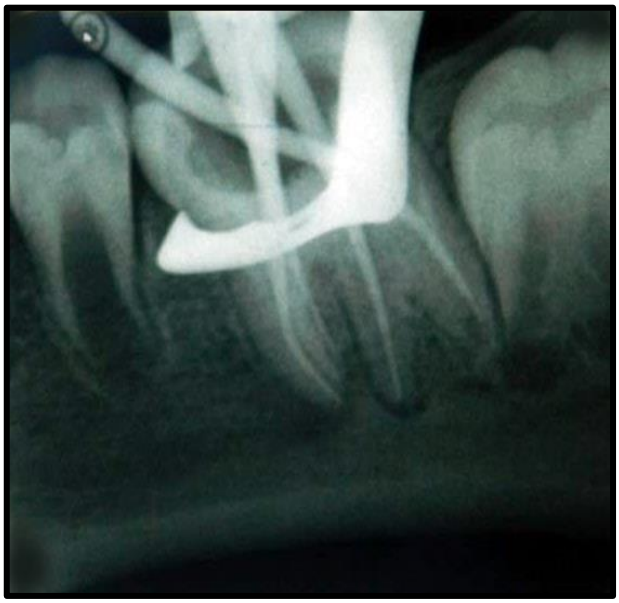

Figure4: Master cone confirmation

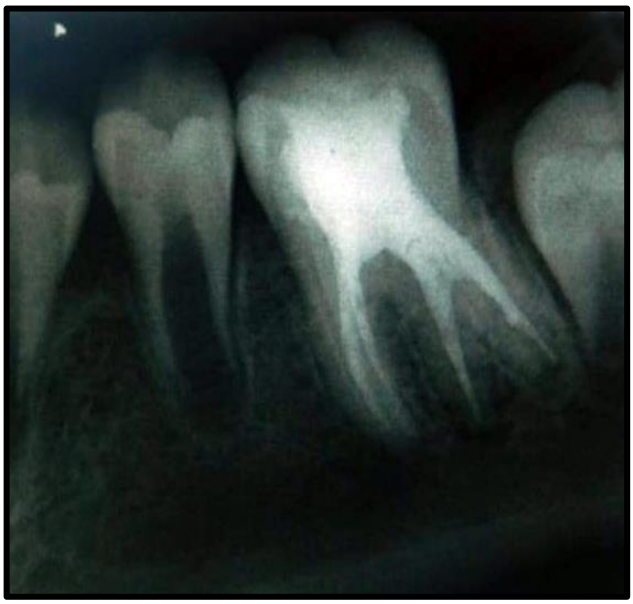

Figure 5: Post obturation radiograph

The prevalence of RE, comparison of occurrence between males and females and between right and left sides of the mandible were recorded using Pearson chi-square test. Statistical analysis was carried out using statistical package of social sciences (SPSS) software (version 16, Chicago, USA) and $p<0.05$ was considered as statistically significant.

RESULTS

37 patients were found to have RE with an overall prevalence of 11% (37/336) (table 1). The incidence was 11.6% (21/181) for females and 10.3% for males (16/155). There was statistically no significant difference in the prevalence of three rooted mandibular first permanent molars between males and females (p=0.709)(table 1).

Table 1: Prevalence of radix entamolaris according to gender

Sex	Radix		Total
	Yes	No	
Male	16 (10.3%)	139	155
Female	21 (11.6%)	160	181
Total	37 (11%)	299	336

P=0.709

The prevalence of RE from the total teeth examined was 10.4% (37/356).Among these three rooted mandibular first molars 20 were found on right side and 17 on the left side (Figure 3). The prevalence was 10.5% (20/190) on right side and 10.2% (17/166) on the left side. The difference was statistically non-significant (p=0.944) (table 2).

Table 2: Prevalence of radix entamolaris according to side of jaw

Side of Jaw	Radix		Total
	Yes	No	
Right	20 (10.5%)	170	190
Left	17 (10.2%)	149	166
Total	37 (10.4%)	319	356

P=0.944

DISCUSSION

The knowledge of existence of RE is essential for the success of endodontic treatment in mandibular molars. Ethnicity has been suggested as a predisposing factor for its presence.[17]In our study the overall prevalence of patients with RE was 11% and 10.4%of all the teeth examined. This figure is lesser than the result of study carried by Chandra et-al in South Indian population (Chennai)

where the prevalence of RE among the patients was18.6%and 13.3% for all the teeth examined.[2] On the contrary these figures are higher than the results of study by Garg et-al[18] in North Indian population where the prevalence of RE was 5.97% of all the patients and 4.55% for all the teeth examined. The results of the present study are in close proximity to the results of previous study carried out by Gupta et-al[19] in Rhotak Haryana, a North Indian state where the prevalence of RE was found to be 13% of all the patients and 8.3% of all the teeth examined. However the prevalence was low when compared with data reported for Asian races: 24.5% in Koreans[20], 32% in Chinese[21], and 25.6% in Taiwanese.[22] Thus a positive relationship exists between the prevalence of RE and geographical place of certain places.

Steelman[23] and Song et-al[24] in their study identified male tendency for RE in mandibular first molar. However Gupta et-al[19] and Bains et-al[25] in their study found more prevalence of three rooted mandibular molars in females. In our study more number of females (11.6%) as compared to males (10.3%) exhibited RE but statistically no significant difference was found between both the genders. This was in accordance with the recent studies byTu et-al[26] and Wang et-al.[27]

In the present study there was statistically no significant difference between left and right sided occurrence of RE which is similar to the recent studies by Bains et-al[25] and Chandra et-al.[28] However some studies reported more predilection on right side.[26, 29] and few others on the left side.[30, 31] These contra indicatory results may be due to the variations in case selection, methods used for detection and sample size. In this study we included the patients who needed endodontic treatment and none of the patient was missed, so the prevalence is real.

In the previous studies two main methods have been used to assess the prevalence of this anatomic macrostructure. Some authors studied this aberration using a radiographic approach[28] while others studied directly from the extracted teeth.[7] The use of extracted teeth for the identification of RE might lead to an underestimation of their frequency because teeth with slender roots can easily be fractured on extracted teeth. Moreover it is impossible to compare the results of these studies related to gender. In this study we just took radiograph of the tooth which needed endodontic treatment, so the patientsdid not receiveextra dose of radiation because of ethical issues.

The periapical radiographs were taken from two different horizontal angles. One of these was taken 30^0mesially to ensure proper identification of three rooted mandibular molar. Computed tomography (CT) or cone beam computed tomography (CBCT) might be a more beneficial tool in this respect but considering the added radiation and cost,periapical radiography seems to be a satisfactory tool.

Extra distolingual roots of mandibular first molar teeth are typically smaller and are usually curved. Carlson and Alexanderson[32] described four different types of RE and De Moor et-al[33] classified type I to type III for RE evaluated from extracted teeth. When the occurrence of RE is confirmed or suspected on the radiograph the conventional triangular access cavity must be modified to rectangular or trapezoidal outline in order to better locate and access the orifice of the additional root located distolingually.

CONCLUSION

The prevalence of RE in this study was 11% for the Kashmiri(North Indian) population and was less than reported for other Asian populations. An accurate diagnosis of RE before root canal treatment is important to facilitate the endodontic procedure and to avoid missed canals and roots. Therefore clinicians must be familiar with all molar abnormalities as well as their prevalence.

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