

PREVALENCE OF ROOT CANAL MORPHOLOGY OF MANDIBULAR MOLAR IN WESTERN NEPALESE POPULATION : A CROSS-SECTIONAL STUDY

Rupam Tripathi,¹ Manisha Nepal,¹ Vanita Gautam,¹ Rinku Sah,¹ Kriti Shrestha,¹ Sujan Thapa¹

ABSTRACT

INTRODUCTION

A main variant in the mandibular molars is the presence of radix entomolaris (RE) and radix paramolaris (RP) in the mandibular first molars and fused roots in 2nd mandibular molar. Hence, the present prospective study intends to evaluate the prevalence of radix entomolaris, radix paramolaris and molars with fused roots in a local population of Western Nepal.

MATERIAL AND METHODS

This is prospective cross-sectional study. The total of 336 patient's mandibular first and second permanent molars having radiological and clinical evidence of pulpal pathology were included in this study. The criteria for the identification of an extra root were justified by crossing of the translucent lines defining the pulp space and periodontal ligaments in the mandibular first molars, and for the mandibular second molars, the outline of the periodontal ligament was followed to see the presence of the fused roots.

RESULTS

Thirty nine patients (24 females and 15 males) showed a supernumerary distolingual root (RE) in mandibular first molars and 42 patients (18 females and 24 males) showed mesiolingual root (RP). The prevalence of patients with radix entomolaris was 11.6% (39 of 336), 13.6% for females (24 of 176) and 9.3 % for males (15 of 160). The prevalence of radix paramolaris was 12.5% (42 of 336), 10.5% (18 of 176) for females and 15% (24 of 160) for males. 54 patients (27 females and 27 males) showed C-shaped canals in mandibular molars. The prevalence of C-shaped mandibular molars was 30% for females (27 of 90) and 34.6% (27 of 78) for males. There was statistically no significant difference in the prevalence of entomolaris, paramolaris and C-shaped canals among male and female population.

CONCLUSION

Failure to diagnose radix entomolaris, paramolaris and fused root may lead to missed canal and incomplete debridement of canal resulting in compromised treatment outcome. The successful endodontic therapy employed all the roots and canals to be located, cleaned, shaped and obturated.

KEYWORDS Radix entomolaris, Radix paramolaris, C-shaped mandibular molars, Distolingual root, Mesiolingual root

1. Department of Conservative Dentistry and Endodontics, UCMS College of Dental Surgery, Bhairahawa, Nepal

DOI: <http://doi.org/10.3126/jucms.v8i1.29836>

For Correspondence

Dr. Rupam Tripathi
Department of Conservative Dentistry and Endodontics
UCMS College of Dental Surgery
Bhairahawa, Nepal
Email: rupam.tripathi121@yahoo.com

INTRODUCTION

The primary objective of root canal therapy depends on the knowledge of the clinician with the complexities of the root canal system.¹ Thus, a thorough knowledge of the root and root canal morphology and their variations are important. The mandibular molars, especially the mandibular first molars bear the masticatory forces, and their treatment are very important. These teeth are known to be present with several anatomical variations, both in the number of roots and the root canals.

According to Swartz, Skidmore and Griffen², mandibular molars especially first molars have a significantly lower success rate compared with other teeth due to the missed canals and the failure to remove all the microorganisms and pulp remnants from the root canal system.³ It is therefore important that clinicians have an awareness and good understanding of the variations in root canal morphology of the mandibular molars. A main variant in the mandibular molars is the presence of a supernumerary distolingual root and mesiobuccal root i.e., radix entomolaris (RE) and radix paramolaris (RP) in the mandibular first molars and fused roots in the mandibular second molars.^{4,5}

Hence, the present prospective study intends to evaluate the prevalence of RE, RP and fused roots in mandibular molars in a local population of Western Nepal.

MATERIAL AND METHODS

This prospective, cross-sectional study was conducted on total of 336 mandibular first molar and 168 mandibular second molar teeth in the Department of Conservative Dentistry and Endodontics, UCMS, Bhairahawa from 1st October 2019 to 31st January 2020. Informed consent regarding objectives of the study was taken from all the patients. Ethical clearance was obtained from the Institutional Review Committee, UCMS, Bhairahawa.

Patient's Mandibular first and second permanent molars having radiological and clinical evidence of pulpal pathology were included in this study. The criteria for the identification of an extra root were justified by crossing of the translucent lines defining the pulp space and periodontal ligaments in the mandibular first molars, and for the mandibular second molars, the outline of the periodontal ligament was followed to see the presence of the fused roots, where the outline was confluent at the apex. The included teeth were free of root resorption, had no calcifications or open apices.

Preoperative radiographs were taken on different angulation i.e., straight on, mesio-oblique and disto-oblique to evaluate the number of roots and canals. Each of these patients had to be

of West Nepali origin with age group ranging from 18 to 60 years. Personal details of age and gender were also recorded. No retreatment cases were included in the study. Selected cases had conventional root canal treatment done.

Local anesthesia ((2% lidocaine hydrochloride and epinephrine 1:200,000; Neon laboratories Ltd., India) was administered. An endodontic access opening was done with round bur (SS White, USA) and Endo Z bur (Dentsply, Tulsa Dental, and USA) under rubber dam isolation. In mandibular 1st molar, the outline of the access cavity was modified to a rhomboidal shape to improve visibility of the extra distolingual or mesiobuccal canal orifice. Gentle troughing of the pulpal floor lingually along the orifice of the distolingual canal was done to identify the possibility of a second distolingual canal or any other additional canal, with a half round bur in case of RE and mesiobuccal direction in case of RP. The contents of the pulp chamber were removed and sharp endodontic explorer and magnifying glass was used to explore the developmental grooves carefully to locate the orifices of the canals. Also, the loupes were used to enhance vision..

Copious amounts of 3% sodium hypochlorite (Prime Dental Products, Pvt. Ltd) solution irrigant was used. Pulp tissue was extirpated using barbed broaches (Nerve Broaches/ Alfred Becht-GmbH, Germany) or H-Files (M access, Dentsply Maillefer). A size 10 K file (M access, DentsplyMaillefer) was introduced into the canal to determine the canal patency and a working length radiograph was taken, using the paralleling technique. In mandibular 2nd molar, After proper orifice enlargement of the root canal, C shaped canal configuration was already visualised. Careful initial penetration of canals with size 10 k file (Dentsply) characterised the C shaped canal configuration more accurately. Apex locator (Propex II, DentsplyMaillefer) was used to take a second working length as an adjunct to the radiographic method. Apical patency was confirmed with a small file (#15 or #20 NitiFlex, DentsplyMaillefer) throughout the procedures after each larger file size. Preparation was completed using stepback of 1mm increments. Irrigants used were 2.5% NaOCl solution and normal saline. Each canal was dried using sterile paper points (Dentsply Maillefer). Afterward, the canals were medicated with a calcium hydroxide paste for 1 week, and then they were obturated by the lateral compaction technique using GuttaPercha (Dentsply Maillefer) and Zinc Oxide Eugenol sealer.

The total percentage of an extra distolingual root, mesiobuccal root in mandibular first molars and fused root in mandibular second molars and their occurrence on the basis of gender were assessed. The data were analyzed using SPSS version 21.0 (IBM Corp. Armonk, NY: IBM Corp) for generation of inferential statistics. The statistical significant difference

among gender was determined by Chi square test. The P value was set at <0.05 to see the statistical difference.

RESULTS

Thirty nine patients out of 336 (24 females and 15 males) showed a supernumerary distolingual root (RE) in mandibular first molars and 42 patients (18 females and 24 males) showed mesiolingual root (RP). The prevalence of patients with RE was 11.6% (39 out of 336), 13.6% (24 out of 176 females) for females and 9.3 % (15 out of 160 males) for males. The prevalence of radix paramolaris was 12.5% (42 out of 336), 10.2% (18 out of 176 females) for females and 15% (24 out of 160 males) for males as shown in Table 1.

Table 1. Frequency (%) of the mandibular first molar with radix endomolaris and radix paramolaris

Total patients N=336	Number and percentage of mandibular first molar with Radix Entomolaris and Radix Paramolaris	
	n	Percentage (%)
Entomolaris	39	11.6
Females (n= 176)	24	13.6
Males (n=160)	15	9.3
Paramolaris	42	12.5
Females (n=176)	18	10.2
Males (n= 160)	24	15

Table 2 shows prevalence (%) of the mandibular molar teeth with C- shaped canals. 54 patients out of total 168 undergoing endodontic therapy (27 females and 27 males) showed C-shaped canals in mandibular second molar teeth. Among gender, prevalence of C-shaped mandibular molars was 30% (27 out of 90 females) for females and 34.6% (27 out of 78 males) for males.

Table 2. Frequency (%) of the mandibular molar with C-shaped canals

Total patients N=168	Number and percentage of Mandibular molars with C-shaped canals	
	n	Percentage
Total patients	54	32.1
Females (n=90)	27	30
Males (n=78)	27	34.6

Table 3 shows the comparison of the prevalence of entomolaris, paramolaris in first mandibular molars and c-shaped canal in 2nd mandibular molars among gender. There was statistically no significant difference in prevalence of entomolaris, paramolaris and C-shaped canals among gender (p<0.05).

Figure 1 and 2 are showing pre and post operative radiograph of radix entomolaris.

Figure 3 and 4 are showing pre- and post-operative radiograph of radix paramolaris.

Table 3. Comparison of occurrence of entomolaris, paramolaris and C-shaped canals among gender

	Category	p-value
Entomolaris	Male	0.277
	Female	
Paramolaris	Male	0.244
	Female	
C-shaped canals	Male	0.647
	Female	

* The mean difference is significant at the <0.05 level

DISCUSSION

Normally, mandibular first molars have one mesial and one distal root with two mesial and one or two distal canals. An additional third root, is called the radix entomolaris (RE). This supernumerary root is located distolingually in mandibular molars, mainly first molars. An additional root at the mesiobuccal side is called the radix paramolaris (RP). Various literatures reported the occurrence of additional roots in both permanent and primary mandibular molars in different populations. However, there is paucity of literatures regarding the occurrence of extra roots in Nepalese population.

In the present study, the prevalence of RE in mandibular first molars among the Western Nepalese patients was 13.6% for females and 9.3% for males, and the overall prevalence among all teeth examined was 11.6%. Acharya Nisha⁶ published an article which reported three mandibular first molars: cases, one with additional mesial root (radix paramolaris) and two with additional distal root (radix entomolaris) and their subsequent endodontic management. The prevalence of these three-rooted mandibular first molars appears to be less than 3% in African populations, not to exceed 4.2% in Caucasians, to be less than 5% in Eurasian and Asian populations, and to be higher than 5% (even up to 40%) in populations with Mongolian traits.⁷ Radix entomolaris is considered to be a normal morphological variant in mongoloid populations due its high occurrence.⁸⁻¹⁰ Bolk L¹¹ reported the occurrence of a buccally located additional root: the RP. This macrostructure is very rare and occurs less frequently than the RE. The prevalence of RP, as observed by Visser JB¹², was found to be 0% for the first mandibular molar, 0.5% for the second and 2% for the third molar. Other studies have, however, reported RP in first mandibular molars.^{13,14} In African population the prevalence rate of RP is reported to be 1.5-3% but it is less

frequent in Indian population with the existence rate of 2%.⁷ The mandibular second molars may present with the mesial and distal root fused at the apex, but having mesiobuccal, mesiolingual, and distal canals; it may present with only two canals, i.e., mesial and distal or only a single canal which is the result of complete fusion of the mesial and distal roots. The incidence of root fusion resulting in a single-root, conical, or C-shaped form is approximately 21.8%.¹⁵

In present study, among the mandibular second molars, the prevalence of teeth having fused roots was 30% for female and 34.6% for males, and the overall prevalence among all teeth examined was 32.1%. The mandibular second molars having fused roots often present a confluence of canals or the C-shaped canals as described by Cook and Cox.¹⁶ In the study by Walker among a Chinese population in extracted teeth, there was a fusion of roots mainly on the buccal side, while the separation on the lingual side varied from a mild grooving to a full separation.¹⁷ In the present study, the presence of fused roots on the basis of confluence of periodontal ligament outline was recorded (Figure 5 and 6). Statistically no significant difference was found in prevalence of entomolaris, paramolaris and C-shaped canals between male and female Population ($P < 0.05$).

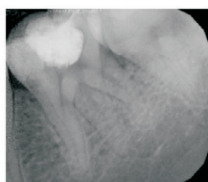


Figure 1: Pre-operative Radiograph

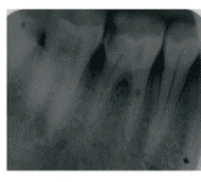


Figure 3: Pre-operative Radiograph

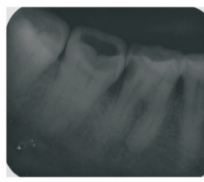


Figure 5: Pre-operative Radiograph

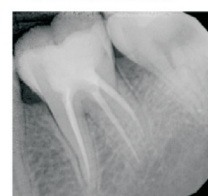


Figure 2: Post-operative Radiograph

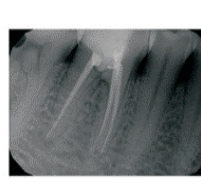


Figure 4: Post-operative Radiograph

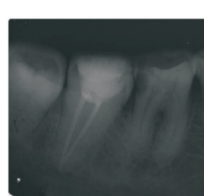


Figure 6: Post-operative Radiograph

CONCLUSION

The diagnosis of any variation from normal with respect to the number of roots or root canals is an important factor in determining the success of root canal treatment. Failure to diagnose RE/RP may lead to missed canal and incomplete debridement of canal resulting in compromised treatment outcome. Hence, for successful endodontic therapy all the roots and canals should be located, cleaned, shaped and obturated.

ACKNOWLEDGEMENTS

We would like to acknowledge all the patients and supporting staffs of the UCMS to carry out this work.

REFERENCES

- Bains R, Loomba K, Chandra A, Loomba A, Bains VK, Garg A. The radix entomolaris: a case report. *Endodontic Practice Today*. 2009 Jun 1;3(2).
- Swartz DB, Skidmore AE, Griffin Jr JA. Twenty years of endodontic success and failure. *Journal of Endodontics*. 1983 May 1;9(5):198-202.
- Himel VT, McSpadden JT, Goodis HE, Cohen S, Hargreaves KM. *Pathways of the Pulp*. 10th ed elsevier 2011.
- Carlsen O, Alexandersen V. Radix entomolaris: identification and morphology. *European Journal of Oral Sciences*. 1990 Oct;98(5):363-73.
- Al-Fouzan KS. C-shaped root canals in mandibular second molars in a Saudi Arabian population. *International Endodontic Journal*. 2002 Jun;35(6):499-504.
- Acharya N, Samant PS, Gautam V, Singh O, Srestha A. Endodontic management of three rooted mandibular first molar: report of three cases. *Journal of Universal College of Medical Sciences* 2014; Vol.02, No. 02 (06)
- De Moor RJG, Deroose CAJG, Calberson FLG. The radix entomolaris in mandibular first molars: an endodontic challenge. *International Endodontic Journal*. 2004 Nov; 37(11):789-299.
- Curzon ME, Curzon JA. Three-rooted mandibular molars in the Keewatin Eskimo. *J Can Dent Assoc (Tor)*. 1971;37(2):712.
- Ferraz JAB, Pécora JD. Three-rooted mandibular molars in patients of Mongolian, Caucasian and Negro origin. *Braz Dent J*. 1993;3(2):113-7.
- Walker RT. Root form and canal anatomy of mandibular second molars in a southern Chinese population. *J Endod*. 1988;14 (7):325-9.
- Bolk L. Welcher Gebireihegehören die Molaren an? *Z Morphol Anthropol*. 1914;17:83-116.
- Visser JB. Beitrag zur Kenntnis der menschlichen Zahnwurzel formen. *Hilversum: Rotting*. 1948;49-72.
- Carlsen O, Alexandersen V. Radix paramolaris in permanent mandibular molars: identification and morphology. *Scan J Dent Res*. 1991;99:189-95.
- Sperber GH, Moreau JL. Study of the number of roots and canals in Senegalese first permanent mandibular molars. *Int Endod J*. 1998;31:112-6.
- Ingle JI, Bakland LK, Baumgartner JC. *Endodontics*. 6th ed. Hamilton: BC Decker Inc.; 2008. p. 208-9.
- Cooke HG 3rd, Cox FL. C-shaped canal configurations in mandibular molars. *J Am Dent Assoc*. 1979;99:836-9
- Walker RT. Root form and canal anatomy of mandibular second molars in a Southern Chinese population. *J Endod*. 1988;14:325-9.