Research Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2021;11:3:392-397.

Evaluation of Extra Roots, Root Canals and C-Shaped Canals in Mandibular Second Premolars in North Bihar Population: A Cone Beam Computed Tomography (CBCT) Based Study

Kamil Shahnawaz[1*] Gaurav Verma[2] Priyanka[3] Tapan Kumar Mandal[4] Gaurav Vishal[5] Shadab Ahmed[6]

[1]MDS, Department of Conservative and Endodontics, MO Dental, PHC, Kharagpur, Munger, Bihar, India.
[2]MDS, Department of Conservative Dentistry and Endodontics, Mithila Minority Dental College, Darbhanga, Bihar, India.
[3]MDS, Department of Conservative Dentistry and Endodontics. Mithila Minority Dental College and Hospital, Darbhanga, Bihar, India.
[4]Senior Lecturer, Department of Conservative and Endodontics, Hazaribagh College of Dental Science and Hospital, Hazaribagh, Jharkhand, India.
[5]MDS, Department of Oral & Maxillofacial Surgery, Fellow in Oral Oncology and Reconstructive Surgery, Bareilly International University, Bareilly, UP, India.
[6]Senior Lecturer, Conservative Dentistry and Endodontics, Sri Siddhartha Dental College And Hospital, Tumakuru, Karnataka, India.

ABSTRACT

Background: In the last ten years, cone beam computed tomography (CBCT) has gained widespread acceptance in dentistry. CBCT was created to improve the diagnostic tools available for dental applications. It helps in the diagnosis of root canal morphology variations, endodontic and non endodontic pathosis, vertical root fracture assessment, root resorption defect examination, and apicoectomy presurgical assessment.

Methods and Materials: CBCT images of 400 mandibular second premolars were obtained using CBCT images from 200 patients (bilaterally). The pictures were taken retrospectively and analysed for the anatomy and number of root canals.

Results: The most common canal configurations in the mandibular second premolars were type I (77.8%) in the current sample. Extra roots were found in 2.3% cases, extra root canal was observed in 22.2% cases and C shaped canals in 4.7% cases. Both males and females were found to have them. In both males and females, bilateral symmetry was observed in the majority of mandibular second premolars. They had no major differences in root and root canal morphology, although there were a few minor variations in some cases.

Conclusion: The current study found that by using this CBCT imaging modality, we can provide more precise diagnosis and treatment planning, reducing any missing canals and anatomical structure overlapping.

Keywords: Cone beam computed tomography, mandibular second premolars, root canals.

INTRODUCTION

The anatomy of a tooth's root canal changes as the tooth grows. Young teeth's roots usually have a single wide canal. Deposition of secondary dentine leads to the creation of partitions, which may lead to significant root canal system differentiation, resulting in the development of separate canals and transverse connecting systems. In roots that are compressed or have external grooves, the transformation of a simple root canal into a complex form is most common.[1]Cementum covers the anatomic root, which stretches from the cement enamel junction (CEJ) to the apex. A root canal begins as a funnel-shaped canal orifice inside the pulp chamber, usually below the cusp tips' core, and

Received: Jan. 19, 2021: **Accepted**: Mar. 22, 2021
*Correspondence Dr. Kamil Shahnawaz.
Department of Conservative and Endodontics, MO Dental, PHC, Kharagpur, Munger, Bihar, India.
Email: kdthe1@gmail.com

pISSN 2278-0076
eISSN 2321-9270

ends in an anatomical foramen, which opens onto the root surface between 0 and 3 mm from the root apex's centre. An accessory canal is a branch of the main pulp canal or chamber that interacts with the root's external surface.[2]

The coronal, or middle third, of the root has a lateral canal that extends horizontally from the main root canal. Since the morphology of root canal systems varies significantly between races and also among individuals within the same race, it is critical to be aware of differences in tooth anatomy and its features in different racial groups. This information may aid clinicians in locating and managing canals during root canal care.[3]

Tooth sectioning, radiographs, post-treatment clinical observation, direct observation with microscope, tooth clearing, 3D reconstruction, and computed tomography have all been used to study canal morphology (CT). In the last ten years, cone beam computed tomography (CBCT), also known as dental volumetric tomography, has gained widespread acceptance in dentistry. It can produce sub-millimeter resolution images of high diagnostic quality in a short scanning period (10–70 seconds) and with radiation doses that are said to be up to 15 times lower than traditional CT scans.[4]

As compared to traditional CT, CBCT offers better precision, higher resolution, shorter scan times, and lower radiation exposures with thin sliced images. Tachibana and Matsumoto introduced CBCT to the area of endodontics in 1990. CBCT technology also assists in the detection of endodontic and non-endodontic pathosis, the assessment of vertical root fractures, the study of root resorption defects, and the presurgical evaluation of apicoectomy procedures. As a result, the current research used CBCT to determine the number and morphology of the root canals of permanent mandibular second premolars.[5]

MATERIALS AND METHODS

A randomised sample of healthy adults who had been recommended to undergo CBCT for a variety of clinical indications, such as implant preparation, trauma, impacted tooth assessment, and so on, was chosen. CBCT images of 400 mandibular second premolars, using their CBCT images (bilaterally). The pictures were taken backwards and analysed for the anatomy and number of root canals. Patients over the age of 18 were eligible, as were mature teeth with completely mature apices and complete diagnostic images free of objects.

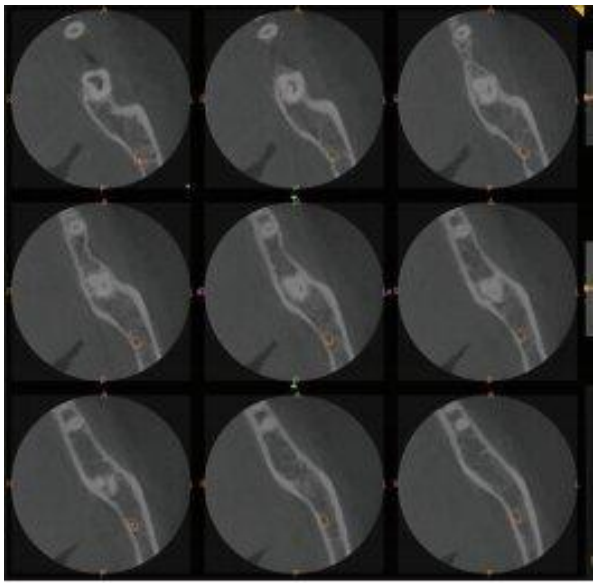

Fig 1: CBCT Axial view .

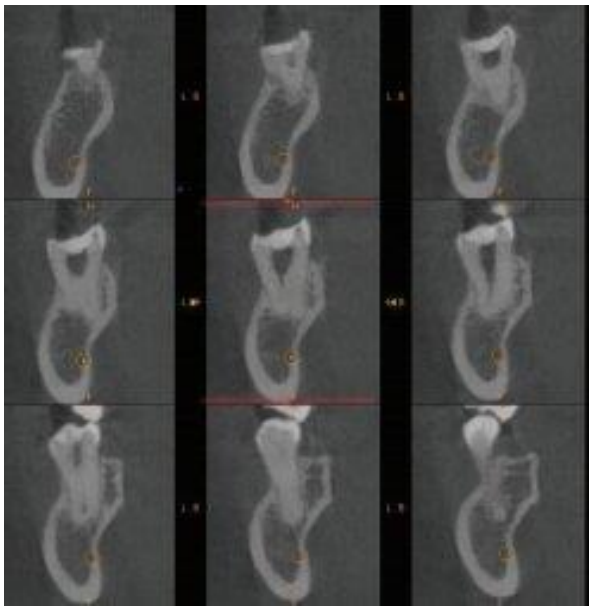

Figure 2: CBCT paraxial

No root canals with open apices, resorption or calcification, no root canal treated teeth, grossly carious, broken tooth, deciduous tooth, photos with distortion or artefacts, and absent second premolars or first or second molars in any quadrant were among the exclusion criteria. A total of 400 mandibular second premolars were examined. CS 3D imaging software was used to examine the teeth.

A Windows Hp Desktop was used to display and evaluate the CBCT files. To ensure optimum visualisation, the software's image processing tool was used to change the contrast and brightness of the images. Orthogonal and oblique slicing is used to examine and study teeth. (Fig 1 and 2) .

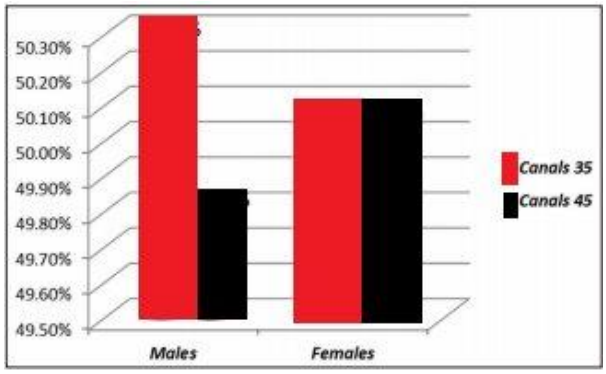

Fig 3: Number of canals: Second premolar right and left male versus second premolar right and left female

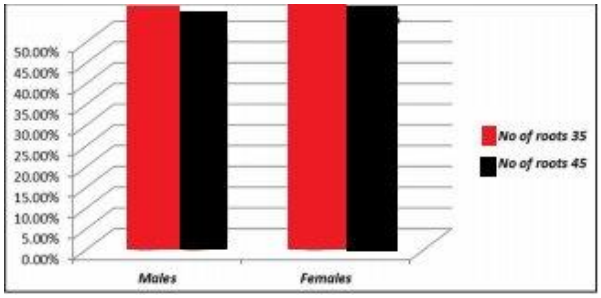

Fig 4: Number of roots: Second premolar right and left male versus second premolar right and left female

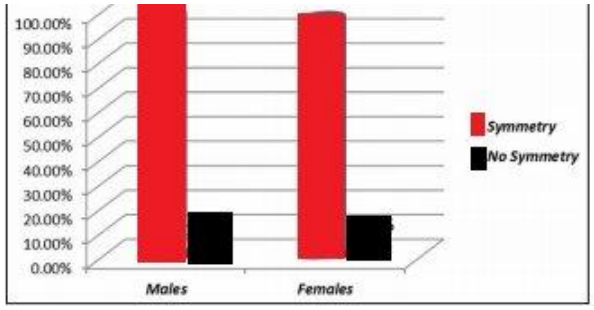

Fig 5: Bilateral symmetry of canals: Male versus female

Teeth included were radiographically examined by CBCT for: 1. The number of roots and root canals in mandibular second premolars bilaterally.2. The root canal morphology of mandibular second premolars according to the Vertucci's classification.[6]

RESULTS

The data was analysed using the statistical programme IBM SPSS statistics 20.0 (IBM Corporation, Armonk, NY, USA), and graphs, charts, and other graphics were created using Microsoft Word and Excel. In this analysis, descriptive and inferential statistical analyses were performed. The categorical measurement results were described as a number (percent). P = 0.05 was set as the level of significance, and any value less than that was considered statistically important. The significance of study parameters on a categorical scale was determined using Chi square analysis.

The following findings were made in relation to the left second premolars (200) and right second premolars (200) that were evaluated: With no difference, both teeth had same root canals. Single root canals were found in both males (50.23 percent left second premolars and 40.76 percent right second premolars) and females (50 percent left second premolars and 50 percent right second premolars). Males (50 percent left second premolars and 50 percent right second premolars) and females (50 percent left second premolars and 50 percent right second premolars) both had single roots on their second premolars (50 percent left second premolars and 50 percent right second premolars)

Between the two premolars, as well as between the genders, there was bilateral symmetry (males 98.13 percent and females 96.87 percent). The left and right second premolars both had Type I canals. It was the same for both males (97.6%) and females (97.6%). (98 percent). The Chi square test resulted in a value of 0.0023 with a P value of 0.9621, indicating that these values are not important since the P value is greater than 0.05.(Fig 3, Fig 4, Fig 5) Extra roots were found in 2.3% cases, extra root canal was observed in 22.2% cases and C shaped canals in 4.7% cases

DISCUSSION

The anatomy and morphology of the root canal system are crucial in endodontic treatments. The most common causes of endodontic treatment failure are missing canals and improper instrumentation. The number of roots and the

position of the canals have been documented in several studies. These involve the presence of a third canal in the mesial root, three canals in the distal root, and five, six, or even seven canals in the mandibular first molar. One of the most significant anatomic variants of the root canal system is the C-shaped canal configuration. Cooke and Cox were the first to propose it.[7,8,9]

The C-shaped cross sectional morphology of the root and root canal gave it its name. The inability of the Hertwig's epithelial root sheath to fuse to the lingual or buccal side causes this condition.To better explain the C-shaped morphology, a variety of classifications have been suggested. The one suggested by Melton et al. was the most widely used. In comparison to the optical operating microscope, CBCT has a high diagnostic accuracy. Furthermore, CBCT with low radiation exposure is favoured over conventional CT analysis for patients who need three-dimensional investigations.[10,11,12]

With the introduction of CBCT, it is now possible to see the dentition, maxillofacial skeleton, and anatomic structure relationships in three dimensions. Over the last decade, CBCT applications in endodontics have achieved widespread acceptance. It aids clinicians by supplying three-dimensional knowledge about the root canal systems' external and internal morphology. The mandibular second premolars were evaluated using the CBCT in this analysis, yielding a detailed report on the number of roots and root canal morphology in males and females, respectively.[13,14,15]

398 (97.7%) of the 400 mandibular second premolars tested had a single root with a single canal. This result was close to that of Felsypremila et al analysis. Alhadainy and Huang et al. also looked at mandibular first premolars in their studies. In the case of mandibular first molars, the majority (100%) had one root in each mesially and distally location. The prevalence of two different roots is close to that found in a previous study of Turkish people by Demirbuga et al., but it is higher than that found in Burmese (58.2%) and Thai people (54 percent).[16,17]

This study's results were close to those published in previous CBCT studies of Turkish and western Chinese populations. In the current research, type IV structure was found in the mesial roots of permanent second molars in 89 percent of females and 92 percent of males. Felsypremila et al. and Wang et al. found that the mesial roots had a high prevalence of type IV configuration, which matched the results of the current research. The type I morphology of the distal roots was the most common, with a frequency of 54 to 72 percent.[17]

Type I canal configuration was found to be the most common after type IV canal configuration, accounting for 14.5 percent of the distal roots in our research. The research also discovered a high prevalence of type IV and type I diabetes. In this analysis, type IV root canal configuration was found to be the most common, accounting for 52 percent, followed by type I at 32 percent, and type II at 16 percent. This result is in line with Demirbuga et aland .'s Ahmed et alfindings. .'s According to Vertucci et al. and Gulabivala et al., type I canal configuration was the most common in the mesial roots. Arslan et al. discovered that type IV canal morphology in the mesial roots was the most widespread in the Turkish population (59.5 percent).[18]

CBCT revealed that form I (74.7%), type II (12.3%), and type IV (9.7%) were the most common types. Similar results were found by Nur et al., Zhang et al found that most mesial roots had more complex canal morphologies, while distal roots had type I configuration in their research on Chinese population using CBCT on permanent mandibular first molars. Trope et al. discovered that black patients had a higher number of extra canals in their mandibular premolars than white patients. In 32.8 percent of first premolars and 7.8 percent of second premolars, black patients had more than one canal. Multiple canals are found in 13.7 percent of first premolars and 2.8 percent of second premolars in white patients.[19]

Park et al. studied the root morphology of permanent mandibular premolars and molars in the Korean community, finding a high prevalence of three-rooted mandibular first molars and C-shaped roots in mandibular second molars. Both of the studies above demonstrate that the root canal system structure varies with different frequencies in different populations. These variations may be due to a variety of factors, including ethnicity of the populations, sample size, and the approach used to research canal morphologies. The most common

configuration in the majority of the population was type IV, which was close to our findings. This may be because our population included most of the Indians from within India.[20]

CONCLUSION

The current study found that by using this CBCT imaging modality, we can provide more precise diagnosis and treatment planning, reducing any missing canals and anatomical structure overlapping.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

REFERENCES

1. Thomas RP, Moule AJ, Bryant R. Root canal morphology of maxillary permanent first molar teeth at various ages. Int Endod J 1993;26:257-67.

2. Vertucci FJ, Haddix JE, Britto LR. Tooth morphology and access cavity preparation. In: Cohen S, Hargreaves KM, editors. Pathways of the Pulp. St. Louis: Mosby; 2006. p. 148-232.

3. Cotton TP, Geisler TM, Holden DT, Schwartz SA, Schindler WG. Endodontic applications of cone-beam volumetric tomography. J Endod 2007;33:1121-32.

4. Tachibana H, Matsumoto K. Applicability of X-ray computerized tomography in endodontics. Endod Dent Traumatol 1990;6:16-20.

5. Vertucci FJ. Root canal anatomy of the human permanent teeth. Oral Surg Oral Med Oral Pathol 1984;58:589-99.

6. Cooke HG 3rd, Cox FL. C-shaped canal configurations in mandibulamolars. J Am Dent Assoc 1979;99:836-9.

7. Melton DC, Krell KV, Fuller MW. Anatomical and histological features of C-shaped canals in mandibular second molars. J Endod 1991;17:384-8.

8. Felsypremila G, Vinothkumar TS, Kandaswamy D. Anatomic symmetry of root and root canal morphology of posterior teeth in Indian subpopulation using cone beam computed tomography: A retrospective study. Eur J Dent 2015;9:500-7.

9. Alhadainy HA. Canal configuration of mandibular first premolars in an Egyptian population. J Adv Res 2013;4:123-8.

10. Huang YD, Wu J, Sheu RJ, Chen MH, Chien DL, Huang YT, et al. Evaluation of the root and root canal systems of mandibular first premolars in Northern Taiwanese patients using cone-beam computed tomography. J Formos Med Assoc 2015;114:1129-34.

11. Demirbuga S, Sekerci AE, Dinçer AN, Cayabatmaz M, Zorba YO. Use of cone-beam computed tomography to evaluate root and canal morphology of mandibular first and second molars in Turkish individuals. Med Oral Patol Oral Cir Bucal 2013;18:e737-44.

12. Wang Y, Zheng QH, Zhou XD, Tang L, Wang Q, Zheng GN, et al. Evaluation of the root and canal morphology of mandibular first permanent molars in a Western Chinese population by cone-beam computed tomography. J Endod 2010;36:1786-9.

13. Ahmed HA, Abu-bakr NH, Yahia NA, Ibrahim YE. Root and canal morphology of permanent mandibular molars in a Sudanese population. Int Endod J 2007;40:766-71.

14. Gulabivala K, Aung TH, Alavi A, Ng YL. Root and canal morphology of Burmese mandibular molars. Int Endod J 2001;34:359-70.

15. Arslan OM, Barutcigil C, Cantekin K. Evaluating root and root canal configuration of mandibular first molars with cone beam computed tomography in a Turkish population. J Dent Sci 2013;8:80-6.

16. Nur BG, Ok E, Altunsoy M, Aglarci OS, Colak M, Gungor E, et al. Evaluation of the root and canal morphology of mandibular permanent molars in a South-Eastern Turkish population using cone-beam computed tomography. Eur J Dent 2014;8:154-9.

17. Zhang R, Wang H, Tian YY, Yu X, Hu T, Dummer PM, et al. Use of cone-beam computed tomography to evaluate root and canal morphology of mandibular molars in Chinese individuals. Int Endod J 2011;44:990-9.

18. Trope M, Elfenbein L, Tronstad L. Mandibular premolars with more than one root canal in different race groups. J Endod 1986;12:343-5.

19. Park JB, Kim N, Park S, Kim Y, Ko Y. Evaluation of root anatomy of permanent mandibular premolars and molars in a Korean population with cone-beam computed tomography. Eur J Dent 2013;7:94-101.

20. Fan B, Cheung GS, Fan M, Gutmann JL, Bian Z. C-shaped canal system in mandibular second molars: Part I – Anatomical feat.