

Incidence of C-shaped canals in mandibular second molars in patients visiting Rehman College of Dentistry, Khyber Pakhtunkhwa (KPK), Pakistan

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ABSTRACT

Objective: The objective of the study was to evaluate incidence of C-shaped canals in mandibular second molars using Cone Beam Computed Tomography.

Study Design: Cross Sectional, Descriptive study.

Place and Duration: This study was undertaken in Department of Radiology, Rehman College of Dentistry, Peshawar, from 15th June 2022 till 15th December 2022.

Methodology: Cone Beam Computed Tomography scans of 60 patients of both genders between 18 and 60 years of age were studied for the presence of C-shaped canals in mandibular 2nd molars. Results were analyzed with the help of SPSS version 21. Chi-square was applied for comparison of male and female groups.

Results: Cone Beam Computed Tomography scans of 60 patients of both genders between 18 and 60 years of age were studied for the presence of C-shaped canals in mandibular 2nd molars. Results were analyzed with the help of SPSS (version 21). Chi-square was applied for comparison of male and female groups ($p > 0.05$).

Conclusion: Incidence of C-shaped canal is high in patients with mandibular 2nd molars. Endodontists need to be vigilant for the existence of C-shaped canals and proper imaging of these canals is essential for successful endodontic treatment.

Keywords: Root Canal Therapy, Molar, C-Shaped Canals, Pulp, Cone Beam Computed Tomography, Endodontic.

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INTRODUCTION

Mandibular second molars are the most common teeth in which C-shaped canals are found.¹ They can be found in other teeth as well such as bicuspid and molars.² They are called C-shaped as they appear like a C in transverse sections of a tooth. A fin connects individual canals and thus gives it its unique shape (figure 1).³ The root of the tooth is fused at either the buccal or

lingual aspect and has a deep pulp chamber.⁴ It is common among the Asian population especially of Far East.⁵ Studies have shown the incidence of C-shaped canals in lower 2nd molars from 2.71 - 31%.⁶ Variation is also present in the configuration of these canals. This can be due to genetic makeup and may have some connection with race-related origin as well.⁷ Conventional radiographs give two dimensional images whereas Cone-beam computed tomography (CBCT) gives exact anatomic details due to imaging in three-dimensional planes. A distinct vision field can be visualized through the CBCT scan which helps in assessing the characteristics of the root canal.⁸ Sagittal, axial and coronal planes give 3-dimensional images thus providing precise anatomical details.⁹

Successful root canal treatment requires preparation of root canals with copious irrigation and cleaning. For this the anatomical detail of the root canal is very essential. As C-shaped canals are common in lower 2nd molars, there is a high chance of perforation due to difficulty in navigating these canals.¹⁰ CBCT is precise for the assessment of C-shaped canals in lower 2nd molars. CBCT has radiation concerns therefore it can't be used for every patient requiring endodontic treatment. Also in our area i.e. Khyber Pukhtunkhwa such hi tech equipment is not readily available. Valuable data will be gathered from this study which will help clinicians in assessing frequency and types of C-shaped canals in patients visiting our part of the world. The

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objective of the study was to evaluate incidence of C-shaped canal in mandibular second molars using CBCT.

METHODOLOGY

This descriptive study was conducted in Department of Radiology at Rehman College of Dentistry, Peshawar after getting ethical approval from ethical committee review board (EC ref: RCD-10-06-123). It was carried out from 15th June 2022 till 15th December 2022. Consecutive sampling technique was used to enroll patients. Sample size was calculated with a 95% confidence level and 80 % power using World health organization calculator for sample size determinations. After taking consent, CBCT scans of 60 patients of both genders above 18 years of age were included. Patients who had restorations or caries in mandibular 2nd molars were excluded.

The radiographs were taken by "Carestream Ger, model 90003D" with 73.9 kv (male patients), 69.9kv (female patients), 10.1mA. These values were adjusted according to manufacturer's radiation protocols for different age groups and genders. Standard resolution of 0.30 mm voxel and 10.80 s was used for all scans. Images were analyzed by using CS Imaging Browser 7.0.20 software. The G* Power software version 3.1.9.4 at a p-Value of 0.05, medium-power (0.3) and confidence level of 95.1% were used for analysis sample size. Presence of C-shaped canals was noted. All the data was recorded in a preformed proforma.

Data Analysis: Results were analyzed with the help of SPSS (version 21). Chi-square was applied for comparison of male and female groups. A p-Value of ≤ 0.05 was considered significant.

RESULTS

Sixty CBCT scans of patients were analysed (N=60), There were 30 females (50%) and 30 males (50%) having mean age of 32.02, ranging from 18-55 years with a standard deviation of 13.45 years (Table I). Out of 60, 12 patients (20%) had C-shaped canals in their lower second molar (Table II). No significant statistical difference was observed between the male and female groups ($P > 0.05$)

Table I: Age and Gender Distribution (N=60)

| Age(Years) | | Gender n (%) | |
|----------------|--------------------------------|--------------|-------------|
| Mean \pm SD | 32.02 years (± 13.45) | Males | Females |
| Range(min-max) | 18-55 years | 28 (46.66%) | 32 (53.33%) |

Table II: Correlation of C-shaped Canals (N=60)

| C-shaped canal | Male | Female | Total | Chi square value | p-Value |
|----------------|------------|------------|---------|------------------|---------|
| Present | 6(21.42%) | 6(18.75%) | 12(20%) | 2.359 | 0.67 |
| Absent | 22(78.58%) | 26(81.25%) | 48(80%) | | |
| Total | 28 | 32 | 60 | | |

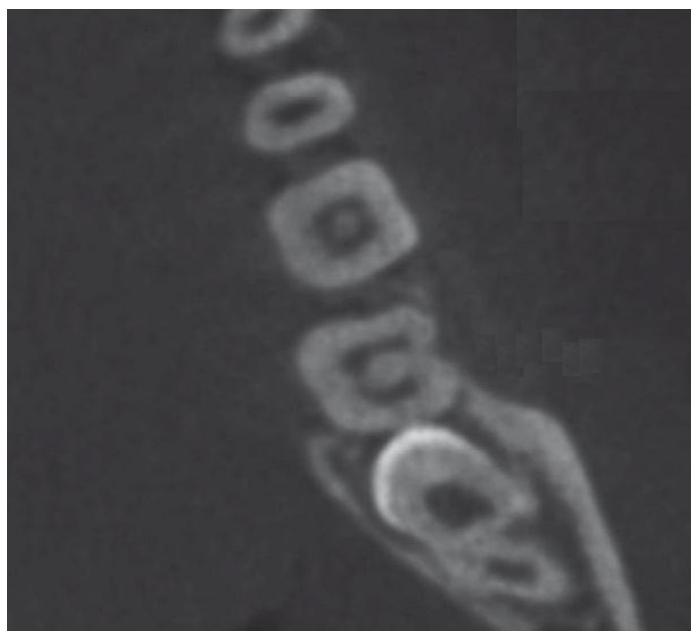


Figure 1: Axial view CBCT showing a C-shaped canal in mandibular 2nd molar

DISCUSSION

Traditional radiographs help operators in successful treatment of teeth but teeth with C-shaped canals pose a greater challenge. The unique C-shape of these teeth may terminate at cement enamel junction area or continue till the apex.¹¹ CBCT with its images in coronal, axial and sagittal planes give precise anatomical detail and help greatly in the success of treatment.¹² Different populations show different incidence of C-shaped canals.¹³ The differences can be due to location, sample size and morphological changes in oral mucosa.¹⁴

The current study recorded C-shape canals to be 20 % in our populations. These canals are recorded to be highest in Chinese population(31.5%).¹⁵ It is rarely seen in Caucasian population.¹⁶ Studies done in middle east countries such as Saudi Arabia also show prevalence of C-shaped canals.¹⁷ Even in Middle Eastern countries there is a difference as in Lebanon the population shows prevalence of C-shaped canals to be 19.1% compared to 10 % of Saudi Arabia.¹⁸ In the subcontinent Indian population shows it to be 7.5%¹⁹ while in contrast our study recorded the prevalence of C-shaped canals to be 20 %. These considerable variations in incidence of C-shaped canals can be due to a number of reasons. Many studies have identified genetics and ethnicity which govern a definite role in the configuration of C-shaped canal in the mandibular second molar.²⁰ According to a number of studies, there is a 70 % chance of presence of C-shaped canal on the contralateral side after its detection on one side.²¹ A number of scientists speculate that C-shaped canals are formed because of inability of Hertwig's epithelial root sheath to merge with the root thus forming a C-shaped canal.²² Our study did not find any statistical significance in prevalence of C-shaped canals in genders. However Studies in India and Korea found that C-shape canals are mostly found in females. Current study found C-shaped canals to be found more in the young age population. Al Fozan et al. found that C-shaped canal

dividing further into different canals were mostly found in patients with ages less than 40 years, however Manning et al. described age related dentin deposition as the major cause of division of C-shaped canals.²³ Our results are in accordance with Al Fozan et al.

CONCLUSION

Incidence of C-shaped canal is high in patients visiting this area. Endodontists need to be vigilant for the existence of C-shaped canals and proper imaging of these canals is essential for successful endodontic treatment.

Recommendation

Further studies need to be carried out to ensure safety of patients with routine use of CBCT scans for endodontic procedures.

Protocols need to be developed by endodontists to successfully diagnose and treats patients with C-shaped canals.

AUTHOR'S CONTRIBUTION

Rehman AZ: Conceived Idea, Designed Research methodology, data interpretation, manuscript writing, manuscript final reading and approval.

Alam I: Data collection

Alam S: Literature search

Arbab KN: Literature review, Statistical analysis.

Askar H: Data collection

Khalid MD: literature review, final draft proof reading

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