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ORIGINAL ARTICLE

In Mandibular Second Molars, Prevalence of C-Shaped Root Canals

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ABSTRACT

Objective: The purpose of this study was to perform cone beam computed tomography (CBCT) to assess the frequency of mandibular second molars with C-shaped root canals in a population living in Pakistan.

Study Design: Retrospective study

Place and Duration: This retrospective study was conducted at Bakhtawar Amin Medical and Dental College during in the period from June, 2022 to November, 2022.

Methods: Total 118 patients were presented with mandibular second molars scheduled for root canal treatment. CBCT scans of patients from diagnostic imaging center were selected. C-shaped root canals were determined by radiographic method using Fan's criteria. The frequency and distribution of canals and their configuration along with the position of lingual/buccal grooves in the images were evaluated. SPSS 22.0 was used to analyze all data.

Results: There were majority 72 (61.02%) females and 46 (38.98%) were males in this study. In our study mean age of the patients was 26.16±13.74 years. Frequency of C-shaped mandibular second molars was found in 12 (10.2%) cases. Among 12 cases, majority of the C-shaped root canals found in right side 7 (5.9%) and 5 (4.2%) C-shaped root canals found in left side. Majority of the C-shaped root canals found in females. Frequency of buccal groove among C-shaped root canals was 6 followed by both buccal and lingual groove in 4 and only lingual groove in 2 cases.

Conclusion: According to CBCT analysis, 10.2% of second molars exhibited C-shaped canals. These teeth stood out due to the presence of a deep buccal groove. Right-sided mandibular second molar presence was statistically significant (P = 0.016), according to the data.

Keywords: CBCT, Mandibular Second Molars, C-shaped canals, Buccal Groove

INTRODUCTION

The primary cause of the C-shaped root structure is the failure of the root sheath, made up of Hertwig's epithelia, to adhere to the buccal and lingual root surfaces [1]. Root canals that are formed like a C can be seen in anywhere from 2.7% to 44.5% of mandibular second molars, however this varies greatly from one community to the next [2,3]. The frequency with which individuals' root canals are formed in the shape of a "C" varies between populations.

C-shaped root canal configurations in mandibular second molars present a difficult challenge for endodontists because of their thin walls and short isthmus [6]. Hence, the success of endodontic treatment depends heavily on familiarity with the typical pulp shape and the likely variances [2].

In a 1979 dentistry journal, Cooke and Cox [5] described the first case of a single-rooted mandibular second molar tooth having a continuous aperture for 2, 3, or 4 root canals. The original suggestion for the classification of C-shaped root canals was made by Menton et al. [6], who based it on the shape of the transverse cross-section; however, distinguishing between groups 2 and 3 was not initially evident. By utilising micro-CT and a modified Melton approach, Fan et al. [19] investigated the morphology of C-shaped root canals in mandibular second molars. C1: a single, unbroken C-shaped root canal; C2: a comma-shaped root canal; C3: two or three distinct root canals; C4: a single root canal with a circular or oval cross section; and C5: no canal cavity evident save at the apex. [3]

Many techniques, including staining and cleaning, sectioning, conventional and digital radiography, computed tomography, and micro-computed tomography, have been employed by researchers throughout the years to examine the morphology of root canals in teeth[7,8]. In recent years, cone beam computed tomography (CBCT) has surpassed canal staining and clearing as the gold standard for determining fine canal anatomy because of its non-invasive nature, widespread availability, and relative accuracy. [9] Data collected via CBCT can also be visualised and analysed in three dimensions (3D) with the help of appropriate software.

After reviewing the relevant literature, we can conclude that no investigation of the root and canal morphology and prevalence of C-shaped configuration in mandibular second molars in the Emirati population has been conducted. Clinicians caring for this population will benefit from having access to such data, as it will allow them to better plan therapy and employ adapted methods to address any potential anatomical complications. In addition, the majority of published research has reported a C-shaped arrangement at particular axial cross-sections of the root, as classified by Fan et al. Nonetheless, there has been talk of a C-shaped canal's shape shifting as it travels down the root. [10] Hence, there is a deficiency in connecting these cross-sections to provide a comprehensive view of the C-shaped canal anatomy from the coronal to apical directions.

Difficulties in debriding and obturating the root canals arise due to the root's anatomical changes along its length.[11,12] In order to properly treat a tooth with a C-shaped root canal, it is crucial to first make an accurate diagnosis of the condition. X-rays can effectively reveal the root canal system's structure without requiring any intrusive procedures from the patient. The operative microscopic examination can provide a clear field of view, allowing for direct observation of the morphologic properties of the pulp chamber floor and orifice and facilitating the recognition of a root canal system in the shape of a C.

With the intention of giving dependable direction for endodontic treatment and improving its success rate, this study used radiography and clinical examination under microscope to examine the prevalence of C-shaped root canal systems in mandibular second molars in a native Pakistani population.

MATERIAL AND METHODS

This retrospective study was conducted at Bakhtawar Amin Medical and Dental College during in the period from June, 2022 to November, 2022 and comprised of 118 patients. Mandibular second molars that had fully formed roots, had fused roots, or both

met the inclusion criteria. A deep notch on the root's lingual or buccal surface, One or more canal sections with the C1, C2, or C3 arrangement.

Deep caries in the second and third molars of the mandible, teeth with open apices, resorption, or calcifications were all reasons to exclude out a patient.

The CBCT scans were loaded into an HP workstation with a 19-inch HP light-emitting diodes monitor set to a resolution of 1280 by 1024. A digital process was used to improve the quality of the photographs for easier viewing. Careful rolling from the pulp chamber to the root apex in the axial tomographic slices allowed the NNT toolbar to assess the canal configuration, additional root presence, and canal count. Coronal, sagittal, and axial slices of the CBCT images were acquired. The findings were agreed upon by the panel of examiners, which consisted of three endodontists and a radiologist. Only canals meeting the criteria established by Fan et al. were classified as C-shaped (2004). To further verify the C-shaped morphology, axial slices were examined at various depths within the root.

Several variables' frequencies and percentages were computed. Fisher's exact test was used for further analysis of the data. A significance level of P 0.05 was used. Statistical Package for the Social Sciences was used for the analysis of the data (SPSS version 22.0)

RESULTS

There were majority 72 (61.02%) females and 46 (38.98%) were males in this study. In our study mean age of the patients was 26.16±13.74 years.(table 1)

Table-1: Included patients with detailed demographics

Variables	Frequency	Percentage
Mean age (years)	26.16±13.74	
Gender		
Male	72	61.02
Female	46	38.98

Frequency of C-shaped mandibular second molars was found in 12 (10.2%) cases.(figure-1)

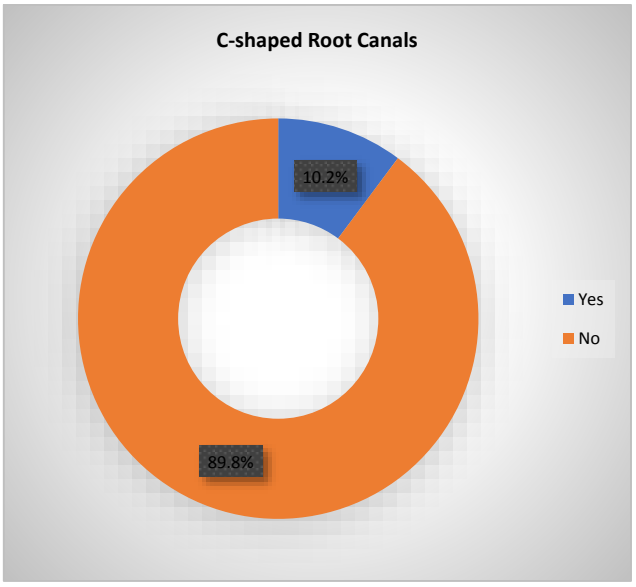

Figure-1: Association of C-shaped root canals among second mandibular molars

Among 12 cases, majority of the C-shaped root canals found in right side 7 (5.9%) and 5 (4.2%) C-shaped root canals found in left side. Majority of the C-shaped root canals found in females.(table 2)

Table-2: Location of C-shape canals and gender association

C-shaped root canals	Frequency	Percentage
Location		
Left side	7	5.9
Right side	5	4.2
Gender		
Male	4	3.4
Female	8	6.8

Frequency of buccal groove among C-shaped root canals was 6 followed by both buccal and lingual groove in 4 and only lingual groove in 2 cases.(figure 2)

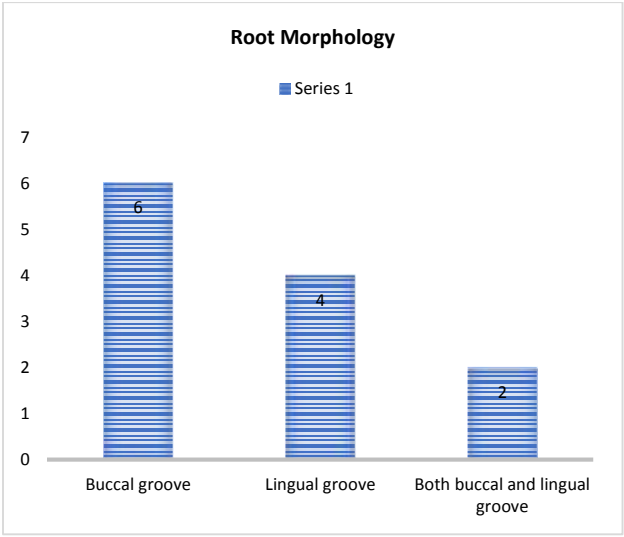

Figure-2: Root morphology of mandibular second canals

DISCUSSION

Root canal therapy necessitates careful attention due to the root canal anatomy's complexity and variety. For the best possible results from root canal therapy, it is essential to have a firm grasp of the anatomy of root canals. It is important to be familiar with the root canal system's normal morphology and any abnormal anatomy before and during surgery. In order to improve the success rate of root canal therapy, it is important to have a thorough understanding of both the exterior and internal root architecture. The lower second molar, like the first molar, typically has two roots and three canals. There are other cases of one-rooted teeth and teeth with three roots. There may only be a single, fused root present, with a restricted range of canal options.

In our study, 118 patients were presented in this study. There were majority 72 (61.02%) females and 46 (38.98%) were males in this study. In our study mean age of the patients was 26.16±13.74 years. These results were comparable to the previous studies.[13,14] Dentists need to understand the intricate root canal anatomy to provide successful endodontic therapy. Using the cleaning approach to determine C-shaped root canal arrangement [15], Rahimi et al. reported a frequency of 7.2% in a Tabrizi population; the present study found a substantially higher incidence of 21.4%. While Madani's study [16] similarly used CBCT images, the prevalence of C-shaped mandibular second molars in the current study was lower at 10.2%. Possible explanations for the inconsistency in findings include differences in sample size, sample origin and source, and root canal configuration identification methods.

Similar to the current study, another CBCT study conducted on a population from Turkey found that 8.9% of mandibular second molars had root canals shaped like the letter "C" [17]. Among 12 cases, majority of the C-shaped root canals found in right side 7 (5.9%) and 5 (4.2%) C-shaped root canals found in left side.

Majority of the C-shaped root canals found in females. Frequency of buccal groove among C-shaped root canals was 6 followed by both buccal and lingual groove in 4 and only lingual groove in 2 cases. Comparable to what was shown in a subpopulation of Brazilians in a 2014 research by Ladeira et al. [18] C-shaped roots have been shown to have a subtle lingual groove in certain investigations, although Fan et al. 2004[19] found no such correlation. Another indication of ethnic diversity among the investigated populations. Around 47.4% of third molars were found to have grooves running in opposite directions. [20]

Fiber-optic transillumination, CT scans, and MRIs are only a few of the tools available for diagnosing three-dimensional anatomy. For these patients, however, CBCT has quickly become the diagnostic method of choice because to its low radiation dosage requirements, user-friendliness, and cost-effectiveness. [21]

CONCLUSION

According to CBCT analysis, 10.2% of second molars exhibited C-shaped canals. These teeth stood out due to the presence of a deep buccal groove. Right-sided mandibular second molar presence was statistically significant (P = 0.016), according to the data.

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