

PREVALENCE OF C-SHAPED ROOT CANALS IN MANDIBULAR SECOND MOLARS IN A SAMPLE POPULATION OF SAUDI ARABIA

LAILA A. BAHAMMAM

ABSTRACT

The aim of this study was to evaluate the prevalence and root canal configurations of C-shaped mandibular second molars of Saudi Arabian population living in the Western and Southern region of Saudi Arabia. 222 mandibular second molars of Saudi patients scheduled for root-canal treatment were examined in different cities in the Western and Southern regions of Saudi Arabia. Data revealed that 14.4% of teeth had C-shaped canals with different anatomical configurations. The prevalence was 10.7% in the Western region and 25.9% in the Southern region. The prevalence was higher in the Southern region compared to the Western region.

Key Words: C-shaped root canals, mandibular second molar, root canal configuration, root canal morphology, Saudi Arabia.

INTRODUCTION

Knowing the anatomy of the root canal system with its different morphologic variations are essential for endodontic treatment success.^{1,2} One of the most important anatomical challenges is the C-shaped configuration of the root canal system. This morphologic variation provides a great treatment challenge.³ C-shaped canal was first reported by Cooke and Cox in 1979.⁴ It is usually found in mandibular second molars and has genetic predisposition. This unusual morphology is more common in Asians.⁵

C-shaped canals come in a great deal of variation and vary in their configuration.^{6,7} Recognizing different configuration facilitates cleaning, shaping, and obturation.⁸ Melton et al.⁷ in 1991 was the first to introduce C-shaped canals classification. This classification included three main categories. Then, it was modified by Al-Fouzan³ in 2002 to further expand category III into three subdivisions.

The prevalence of the C-shaped canals in a large country similar to Saudi Arabia was not fully studied. Most of the studies were conducted in different countries and their results may not be relevant to Saudi Arabian population. We came across two studies^{3,9} which were conducted in Saudi Arabia however, they were done in the same city (similar population). The

sample of those studies were not fully representative of the Saudi population. Hence, there is a need to expand the sample population and include other areas of Saudi Arabia. Therefore, the aim of this study was to investigate the prevalence and root canal configurations of C-shaped mandibular second molars of Saudi Arabian population living in the Western and Southern region of Saudi Arabia.

MATERIAL AND METHOD

The study was approved by a local ethical committee (#602). Over a 1-year period from January to December 2017; 222 mandibular second molars of Saudi patients scheduled for root-canal treatment were examined by postgraduate Endodontic students in different cities in the Western and Southern regions of Saudi Arabia. These cities were Jeddah, Makkah, and Albaha.

The author (LB) met with all postgraduate student, explained the nature of the study, presented detailed instruction both radiographically and clinically, and answered all their inquiries. Those who were interested in participation signed in and provided their emails and contacts. Then, a form was sent to them via emails, which they were asked to fill once they have a mandibular second molar to treat.

Teeth were examined radiographically and clinically for the incidence of C-shaped canals. Three preoperative radiographs were taken using parallel technique to know the number and the position of the root. Clinically, the pulp chamber and canal orifices were examined and the root canals were negotiated with size 10 K-files (Kerr Co., Romulus, MI, USA). To check canal's morphology and its configuration, radiographs were taken with size 15 K-files placed in the canals.

Corresponding Author: Laila A. Bahammam, B.D.S (Hon), M.Sc, Cert. Endo, Ms.Med, Post doc.Associate Professor, Department of Endodontics, Faculty of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia P. O. Box 80209 Jeddah 21589 Kingdom of Saudi Arabia Mobile +966559996256 Fax: +966126403316 lbahammam@yahoo.com lbahammam@kau.edu.sa ORCID ID: <http://orcid.org/0000-0001-9075-361X>

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Teeth with C-shaped anatomy were classified using a modification of Melton et al. classification (Figure 1).³

Category I: C-shaped canal continuously running from the pulp chamber to the apex (true C-shaped canal).

Category II: a separation between the main C-shaped canal and a distinct mesial canal by dentin, giving a semicolon (;) shaped orifice.

Category III:

Subdivision I, C-shaped orifice present at the coronal third that divided into two or more distinct canals that joined apically.

Subdivision II, C-shaped orifice present at the coronal third that divided into two or more distinct canals in the middle third to the apex.

Subdivision III, C-shaped orifice that divided into two or more distinct canals in the coronal third to the apex.

Data were collected and statistically analyzed.

RESULTS

Of the 222 treated mandibular second molars, 32 teeth (14.4%) had C-shaped canals. In the Western region, 168 mandibular second molar were treated, 18 (10.7%) teeth exhibited C-shaped canals. Whereas in the Southern region, 54 mandibular second molar were treated, 14 (25.9%) teeth exhibited C-shaped canals (Table 1).

Regarding C-shaped canal configurations, eight molars (25%) presented a continuous C-shaped canal

(category I), ten (31.25%) had a semicolon shape (category II) and the remaining fourteen (43.75%) had

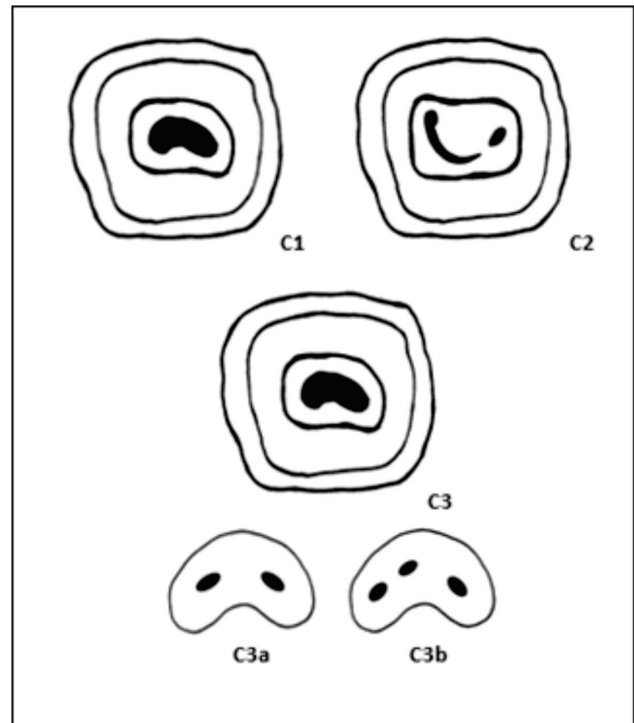


Fig 1. Modification of Melton et al. classification of C-shaped canal configuration at the orifice level. Category 1 (C1): true C-shaped canal. Category 2 (C2): a semicolon shaped orifice. Category 3 (C3): C-shaped orifice present at the coronal third that divided into two (C3a) or more (C3b) distinct canals.

TABLE 1: PREVALENCE OF C-SHAPED MANDIBULAR SECOND MOLARS IN DIFFERENT REGIONS OF KSA.

| | Total no of Mandibular Second Molars | Mandibular Second Molars with C-shaped Canals | % |
|-----------------|--------------------------------------|---|------|
| Western Region | 168 | 18 | 10.7 |
| Southern Region | 54 | 14 | 25.9 |
| Total | 222 | 32 | 14.4 |

TABLE 2: PREVALENCE OF C-SHAPED MANDIBULAR SECOND MOLAR ROOT CANAL CONFIGURATION IN DIFFERENT REGIONS OF KSA.

| | Category I | Category II | Category III | | | Total |
|-----------------|------------|-------------|---------------|----------------|-----------------|-------|
| | | | Subdivision I | Subdivision II | Subdivision III | |
| Western Region | 6 | 8 | 0 | 0 | 4 | 18 |
| Southern Region | 2 | 2 | 2 | 0 | 8 | 14 |
| Total | 8 | 10 | 2 | 0 | 12 | 32 |
| % | 25 | 31.25 | 6.25 | 0 | 37.5 | 100 |

category III. Amongst those of category III: two (6.25%) were subdivision I; and the remaining twelve (37.5%) were subdivision III (Table 2).

DISCUSSION

Several studies have been conducted to study the anatomic configuration of the root canal system of mandibular second molars with diverse results.^{3-7,9-20} These variations may be due to the difference in the design of the study, canal identification technique or to racial divergence. The prevalence of C-shaped root canal system configurations in mandibular second molars was reported to be ranged from 2.7 to 44.5% depending on the study.²¹ The highest prevalence of C-shaped canals was found in Asian populations. The highest prevalence was reported in Korean²² (44.5%), Chinese^{6,23} (29 - 39%), Burmese¹⁷ populations (22.4%), followed by Indian²⁴ (12.3%) and Thai¹⁸ (10%) populations. However, the prevalence in Europe was 14% in Russia²⁵, 8.5% in Portuguese²⁶ and 5% in Greek.²⁷ Whereas, it was 14.2% in Mexican²⁴ and ranged from 3.5 to 15.3% in Brazilian^{25,28} populations.

In the Middle East, the prevalence was ranging from 7.2 to 19.1%.^{20,29,30} The highest prevalence was reported in Lebanese²⁹ population (19.14%) whereas, the lowest was in Iranian²⁰ population (7.2%). A prevalence of 10% was reported in most of the Middle East studies as in Jordanian³¹, Sudanese³² and Saudi Arabian^{3,9} populations.

In our study the prevalence was found to be 14.4% which is higher than most of the Middle East countries. However, by observing the results of each region, the prevalence in the Western region was 10.7%, which is similar to most of the Middle East studies. However, the prevalence in the Southern region was 25.9%, which is higher than the results of all the Middle East studies and some parts of the world. The higher results of the Southern region increased the prevalence of C-shaped canal in our study.

Several techniques have been utilized to investigate the root canal system of mandibular second molars including C-shaped canal systems.^{3,9,27,33-36} The use of recent technology as CBCT was not an option in our study because of the lack of its availability in some of the training centers that participated in the study. In order to standardize the methodology, conventional radiographs were used.

Conventional radiographs were used in numerous studies to recognize C-shaped canal systems.^{3,27} However, by using this technique alone, it was challenging to diagnose different anatomical variation.⁴ In order to determine canal anatomy of the mandibular second molar, Weine et al.³⁷ recommended inserting files in the canals. However, using 2D radiographic tech-

nique may not provide the expected results. Al-Fozan³ mentioned that in some cases it might be difficult to diagnose C-shaped canal using radiographic technique alone. He suggested that exploring the access cavity is necessary to approve the diagnosis. In our study, both radiographic and clinical examination were used to overcome the limitation of radiographic technique. Our findings were in agreement with other latest studies using different study designs.^{9,31,32}

Modification of Melton et al.'s classification³ of canal system types was used to describe the C-shaped canal. In our study, the majority of the canals found were category III (subdivision III) (37.5%) which in agreement with Manning⁵ and Al-Fozan³ studies. Category II occurred in 31.25% of the canals, which is a separation between the main C-shaped canal and a distinct mesial canal by dentin, giving a semicolon (;) shaped orifice. However, true C-shaped canal, which is a single C-shaped canal that is continuously passing from the pulp chamber to the apex was found in 25% of cases (category I). These results are in agreement with Al-Fozan study.³

Limitations of the study and future recommendations

Further studies with larger sample sizes and different study designs using recent technology should be conducted to confirm these results. In addition, other regions of Saudi Arabia could be include as well.

CONCLUSIONS

The prevalence of C-shaped root canal in mandibular second molars in Saudi Arabian population was 14.4% with different anatomical configurations. The prevalence was higher in the Southern region (25.9%) compared to the Western region (10.7%).

Conflict of Interest

The author declare no conflict of interest.

Disclosure

The author did not receive any type of commercial support either in forms of compensation or financial for this study. The author has no financial interest in any of the products or devices, or drugs mentioned in this article.

Ethical Approval

Obtained from the ethical committee of the Faculty of Dentistry, King Abdulaziz University.

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