



# A Cone -Beam C computed Tomographic Assessment of C-shaped canals in mandibular second molars in Delhi -NCR population.

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## ABSTRACT

**Background:** The C-shaped root canal system is one example of an anatomic variation. The present study was conducted to assess the C-shaped canal in permanent maxillary and mandibular second molars in Delhi -NCR population.

**Materials & Methods:** 120 CBCT scans of mandibular second molars with fully formed apices and without signs of resorption were selected. Serial axial, coronal, and sagittal CBCT images were examined. The identification of a C-shaped canal and canal configuration was based on Melton et al.

**Results:** Out of 120 patients, males were 75 and females were 45. The C- shaped canal was present in 30 and absent in 90 cases. The difference was significant ( $P < 0.05$ ). C-shaped canal configuration was continuous in 62, semicolon in 41, and separated in 17 patients. The difference was significant ( $P < 0.05$ ).

**Conclusion:** The most common C-shaped canal configuration was continuous. The prevalence of C- shaped canals was 25%.

**Keywords:** C-shaped canal, Molar, semicolon

## Introduction

Endodontic treatment demands careful cleaning, debridement, and obturation of root canals to ensure successful results. Sufficient knowledge about root canal morphology and canal configuration is required in order to avoid failure. A single-rooted tooth with a single canal poses fewer challenges as compared to a multi-rooted tooth with multiple canals.<sup>(1)</sup>

Anatomical variations such as a C-shaped root canal system are not uncommon. It was first reported in the literature by Cooke and Cox.<sup>(2)</sup> On the basis of the appearance of a cross-section of the canal as an alphabet C they elucidate the C-

shaped canal system.<sup>(3)</sup> At the floor of the pulp chamber the orifice of the canals is connected with ceaseless slit whereas it may or may not be associated with each other in rest of the length of the roots. The Key anatomic feature is that the orifice may appear as ribbon shaped arc of more than 180 degree but it may or may not be connected with isthmus in middle and apical third of the root.<sup>(4)</sup>

Among various teeth, the occurrence of C- a shaped canal in mandibular second molars show variation in configuration. A careful timely assessment of these variations permits thorough cleaning, shaping, and obturation of the canal

system. <sup>(5)</sup> Radiographs of second molars reveal close fused roots or two separate roots. The chances of missing these variations are more owing to the presence of thin canal and sometimes these are not appreciable on radiographs therefore the recognition of C- shaped canals are only possible once the Endodontist obtains access. The present study was conducted to assess the C-shaped canal in permanent mandibular second molars in Delhi -NCR population.

### Materials & Methods

This prospective study comprised 120 CBCT scans of patients of either gender who voluntarily agreed to participate in the study.

The demographic data of each patient was entered in Performa. All were made aware of the procedure of taking CBCT scan with the machine Planmeca operating at 120 KVp, 10 MA, and an exposure time of 18 seconds. A CBCT scan was obtained and all coronal, axial, and sagittal planes were formed. Melton et al criteria for assessing a C-shaped canal were used as an assessment tool. Category number 1 indicates a Continuously-shaped canal, category number 2 indicates Semicolon-shaped canal, and category number 3 depicts separate and discrete canals was followed. Only those images showing fully formed mandibular second molar root with no signs of resorption were selected whereas images showing apical cut-off or poor images were discarded. NNT software version 20.0 was used for assessing the images. All images

were studied by an expert in CBCT evaluation. In order to avoid bias, three readings were taken, and the mean of these readings was selected as the final one. After recording all parameters, results were entered in an MS excel sheet for statistical analysis considering the level of significance ( $P < 0.05$ ).

### Results

**Table I Distribution of patients**

Total- 120		
Gender	Males	Females
Number	75	45

Table I shows that there were 75 males and 45 females in our study.

**Table II Prevalence of C-shaped canal**

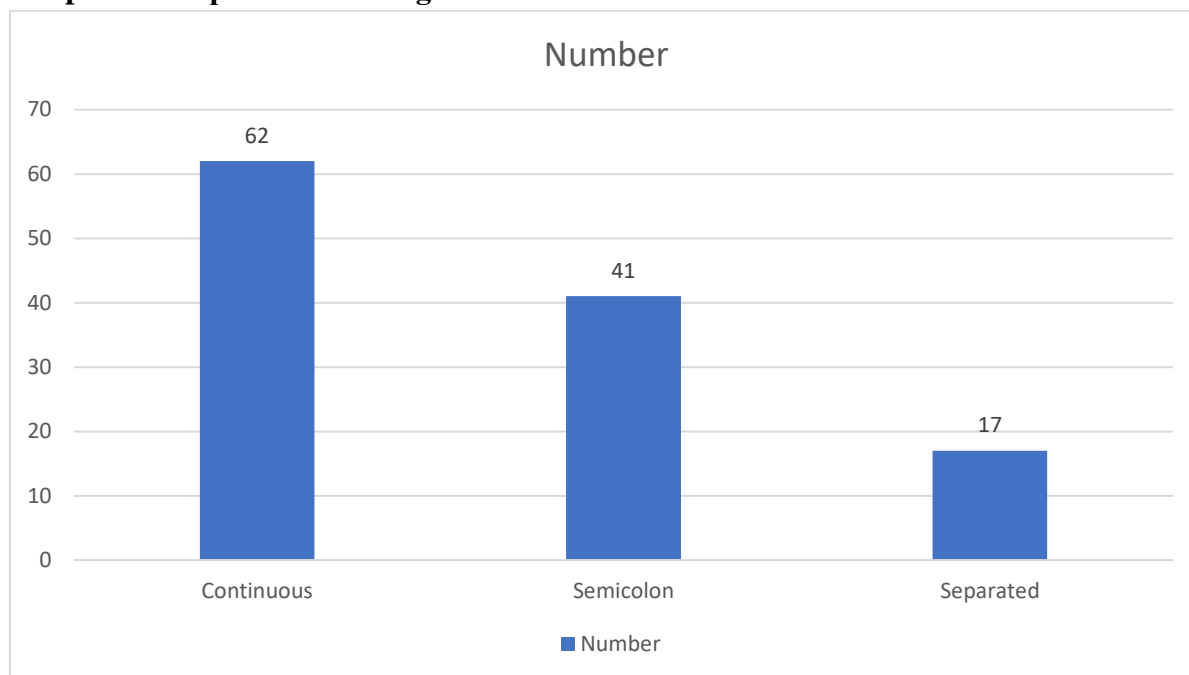
C-shaped canal	Number	P value
Present	30	0.01
Absent	90	

Table II shows that C- the shaped canal was present in 30 and absent in 90 cases. The difference was significant ( $P < 0.05$ ).

**Table III C-shaped canal configuration**

C-shaped canal	Number	P value
Continuous	62	0.02
Semicolon	41	
Separated	17	

Table III shows that the C-shaped canal configuration was continuous in 62, semicolon in 41, and separated in 17 patients. The difference was significant ( $P < 0.05$ ).

**Graph I C-shaped canal configuration**

### Discussion

During morphogenesis, below the amelocemental junction Hertwig's epithelial sheath bends in a horizontal plane. Coalescence of epithelial sheath in the center leads to openings for roots. <sup>(7)</sup> This phenomenon is the key feature to deciding the shape and number of roots. Formation of Fused roots either by fusion due to cementum deposition over the period or maybe because of failure of formation of Hertwig's epithelial sheath in the furcation area. This result, in the formation of a C-shaped canal with a fusion of buccal or lingual aspects of the mesial and distal roots. <sup>(8)</sup> The present research evaluates the presence of a C-shaped canal in permanent mandibular second molars in the Delhi NCR population.

Our study showed that out of 120 patients, males were 75 and females were 45. C-shaped canals were present in 30 and absent in 90 cases.

Al- Fouzan et al <sup>(9)</sup> assessed the occurrence of C-shaped canals in lower 2nd molars. In their study 151, lower second molars selected for endodontic therapy were studied over the span of one year. Clinical, as well as radiographic evaluation, was performed. It was seen that 10.6% <sup>(6)</sup> cases had C-shaped canals. Category I had 5 teeth, category II had three cases, and category III was seen in eight cases. The authors stressed the fact that a careful assessment of C-shaped canals in mandibular second molars is essential to avoid failure and ensure successful endodontic treatment.

We observed that the C-shaped canal configuration was continuous in 62, semicolons in 41, and separated in 17 patients. Singh et al <sup>(10)</sup> evaluated the incidence of a C-shaped canal in permanent upper and lower 2<sup>nd</sup> molars. In this study, 500 CBCT scans of patients were obtained. It was observed in the study that 22% of patients demonstrated C-shaped canals. Continuous C-shaped

canals were observed in 52.7% (58 teeth), semicolon shaped canals were observed in 37.3% (41 teeth) and 10% (11 teeth) of the sample perceived separate canals. Results were statistically significant ( $P < 0.05$ ). Weine et al <sup>(11)</sup> studied seventy- five non-carious extracted mandibular second molars and the canal configuration were classified based on radiographic evaluation of the teeth after the placement of files and taken from two directions. The Result of the study revealed that one tooth had a single canal whereas C- shaped canal was evident in two teeth. In the mesial root, type I was observed in three teeth, type II in thirty- nine teeth type III in thirty teeth. In the distal root, sixty- four teeth had a type I, seven teeth had a type II, and one tooth had type III. The authors advocated the need of taking radiographs at different angulations in order to assess canal configuration, especially in mandibular second molar cases.

In another study by Jin et al <sup>(12)</sup> reported a continuous C-shaped canal in 21.8% of the sample at the pulp chamber floor level, 44.5% were appeared as a semicolon, and 7.7% were mentioned as separated. Haddad et al <sup>(13)</sup> reported that the presence of single continuous true C-shaped canals was the exceptionally rare. With the advent technology of CBCT a clinician can easily identifies the anatomical variation and that result in successful endodontic outcome. However, quality randomised controlled trials are needed for formulation of practice based guidelines.<sup>(14)</sup>

### Conclusion

The authors found that the most common C-shaped canal configuration was continuous. The prevalence of C- shaped canals was 25% in Delhi- NCR region. Use of advanced diagnostic aid such as

CBCT is recommended to assess the anatomy of C-shape root canal system so that clinician can modified the treatment modalities which will further enhance the success of endodontic outcome.

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