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Dentistry

Frequency of C-Shaped Canals in Mandibular Permanent Second Molar among Hyderabad Population

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ABSTRACT

Objectives: The objectives of this study were to assess the frequency and configuration of C-shapedcanal in mandibular second molar teeth.

Study Design: Descriptive type of study

Place and Duration of Study: This study was performed at the Dental OPD, Department of Operative Dentistry, Liaquat University Hospital, Hyderabad / Institute of Dentistry, Liaquat University of Medical and Health Sciences, Jamshoro from June 2010 to December 2010.

Materials and Methods: A total of 100 extracted mandibular second molars were collected. The teeth were stored in 0.9% physiological solution (Otsuka Pakistan Ltd:) after extraction. Calculus and the remainder of periodontal tissue were thoroughly removed by a curette. All the samples were then rinsed with tap water and dried with air. Each tooth was opened to gain access of the pulp chamber by a small round bur (Mani, Japan). The pulp chamber was injected with the 0.5% methylene blue (BDH Gurrcertistan chemical Ltd: Poole England). The contrast color penetrated through pulp-down to the pulp orifice of the root canal. All the teeth were resected transversally at the cemento-enamel junction by a thin diamond disc (Mani, Japan) and the crowns were discarded. The canal orifices were located by DG-16 endodontic explorer. The same diamond disc were used for cutting roots transversally into two more sections at middle 3rd and 2mm above the root apex. All these three section were studied under operating microscope (66 vision tech: Co. Ltd: Sozhou, China) for anatomical properties mentioned in objectives.

Results: Thirteen C-shaped canals were found out of 100 mandibular second molars. 03 were of category I & II respectively and 07 were of category III.

Conclusion: The present study demonstrated that mandibular second molar teeth have variations in terms of number of roots, number of canal orifices and canal morphology. Therefore it cannot be assumed that these teeth always have two-roots and three canals. The overall prevalence of C-shaped canal was found 13% in the local population. The difference to other studies may be attributable to racial differences and study model.

Key Words: Canal Configuration, C-shaped Canal,Endodontic Treatment, Mandibular Second Molar

INTRODUCTION

The knowledge of both normal and unusual configuration of the pulp and possible variation is essential for accomplishment of endodontic treatment. and lack of such knowledge may lead to treatment failure.[1,2] The C-shaped canal configuration is one of anatomical variation seen in mandibular second molars and can cause serious difficulties in endodontic treatment. The number of studies demonstrated that C-shaped canals in mandibular second molar vary in numberand shape along the root length, making cleaning, shaping, and obturation of these teeth difficult.[2]

Cooke and Cox (1979)[3] firstly recognized this anatomical variation and was named as C-shaped because of cross sectional morphology at the root and root canal, which resembles the English letter C in shape. In its place of having numerousseparate orifices the pulp chamber of C-shaped molar is a ribbon shaped orifice with a 180º arc starting at the mesiolingual line angle and curving around the buccal side.[3]

Melton et al (1991)[4] classified the C-shaped canals into three types.

Type I: The continuous C-shaped canal.

Type II: The semicolon shaped canal.

Type III: Two discrete and separate canals.

He further added that C-shaped canals could vary in number and shape along the length of the root.

Subdivision-I: C-shaped orifice in the coronal third that divides into two or more discrete and separate canals that join apically;

Subdivision-II: C-shaped orifice in the coronal third that divides into two or more discrete and separate canals in the mid root to the apex;

Subdivision-III: C-shaped orifice that divides into two or more discrete and separate canals in the coronal third to the apex.[4]

There were several studies conducted on the frequency of C-shaped canals in mandibular second molar in different population and reported its occurrence from 2% to 40%.[1,5-11] Some studies also indicate that C-shaped canal is more frequent in Asians.[12]

There is lack of research on the C-shaped canal configuration in our population. The purpose of this study was to assess the frequency of C-shaped canal in our population, which is important to increase the quality and success of endodontic treatment in C-shaped molar teeth.

MATERIALS AND METHODS

This descriptive type of study was performed at the Dental OPD, Department of Operative Dentistry, Liaquat University Hospital, Hyderabad / Institute of Dentistry, Liaquat University of Medical and Health Sciences, Jamshoro from June 2010 to December 2010. The study was conducted on 100 extracted mandibular second molar teeth having non probability (Convenience).

Inclusion Criteria:

- Human mandibular second molars extracted due to periodontal reasons

Exclusion Criteria:

- Fractured teeth
- Grossly carious teeth with root resorption
- Teeth with incomplete root formation
- Endodontically treated teeth

Data Collection Procedure: A total of 100 extracted mandibular second molar were collected from the Dental OPD, Liaquat University Hospital, Hyderabad.

The identification of mandibular second molar was confirmed by two independent observers had more than 10 years clinical experience in tooth morphology/ endodontics.

Extracted teeth were stored in 0.9% physiological solution (Otsuka Pakistan Ltd:) after extraction. Calculus and the remainder of periodontal tissue were thoroughly removed by a curette. All the samples were then rinsed with tap water and dried with air.

Each tooth was opened to gain access of the pulp chamber by a small round bur (Mani, Japan). The pulp chamber was injected with the 0.5% methylene blue (BDH Gurr certistan chemical Ltd: Poole England). The contrast colour penetrated through pulp-down to the pulp orifice of the root canal. All the teeth were resected transversally at the cemento-enamel junction by a thin diamond disc (Mani, Japan) and the crowns were discarded. The canal orifices were located by DG-16 endodontic explorer. The same diamond disc was used for cutting roots transversally into two more sections at middle 3rd and 2mm above the root apex. All these three section were studied under operating microscope (66 vision tech: Co. Ltd: Sozhou, China) for anatomical properties mentioned in objective. The data was recorded in pre-design proforma.

Data Analysis: The data was analyzed by using the software SPSS version 11.The frequency and percentage was calculated for C-shaped, non c-shaped canal configuration, number of orifices, roots and root canals. The mean and standard deviation (SD) was calculated for number of orifices, roots and root canals.

RESULTS

Total 100 extracted mandibular second molar teeth were selected based on inclusion and exclusion criteria. Out of 100 teeth, 18(18.0%) were single rooted, 80(80.0%) were two-rooted while 2(2.0%) were three-rooted (Table No.1).

In the current study, according to Melton's classification, 13(13.0%, n = 100) teeth had C-shaped canal in mandibular second molar(Table No. 2). Of these, 03(23.0%, n = 13) had the configuration of C1 and C3 respectively whereas 07(53.84%, n = 13) teeth had the configuration of C2 (Table No. 3).

Table No. 1: Number of roots, canal and c-shaped configuration in mandibular second molar (n = 100)

No. of Roots	No. of Canals				Types of C - Shaped			C - Shaped n = 13
	01	02	03	04	C 1 n = 3	C 2 n = 7	C 3 n = 3	
Single rooted, 18(18.0%)	03	11	04	0	3	5	-	08
Two rooted, 80(80.0%)	0	15	61	04	-	2	3	05
Three rooted, 02(2.0%)	0	0	01	01	-	-	-	0

Table No. 2: Frequency of c - shaped in mandibular 2nd molar (n = 100)

C – Shaped	Frequency	Percentage
C - shaped	13	13.0%
Non c - shaped	87	87.0%

The results of present study showed that out of 18 single rooted mandibular second molars, 3 had one canal, 11 had two canals, and 4 had three canals. Out of 80 two rooted mandibular second molars, 15 had two canals, 61 had three canals and 4 had four canals. Out of 2 three rooted mandibular second molars, 1 had three and four canals respectively (Table No.1).

In this study, the prevalence of C-shaped mandibular second molars was present in 13(13.0%, n = 100) teeth. Out of them, 8 teeth had single rooted and 5 had two roots.

Out of 100 teeth, 03 had one orifice, 26 had two orifices, 3 orifices were seen in 66 teeth and 5 teeth had four orifices (Table No.4).

Table No. 3: Configuration of c - shaped according to melton's classification (n =cong 13)

Types of C – Shaped	Frequency	Percentage
C 1	03	23.0%
C 2	07	53.84%
C 3	03	23.0.%

Table No. 4: Number of orifices in mandibular second molar (n = 100)

Number of Orifices	Frequency	Percentage
1	03	3.0%
2	26	26.0%
3	66	66.0%
4	05	05.0%

DISCUSSION

C-shaped canal is one of the most challenging situations while during performing endodontic treatment. It wasactually the Keith (1908) who first described this unusual anatomical variation and latter Cook and Cox (1979) demonstrated it more clearly and also described its various categories. The C-shapedconfiguration of the root canal develops as result of partial or complete merging of roots. As this merging process does not necessarily involve all the roots so resulting in the development of a shape resembling a large letter "C", but it can also resemble a small letter "c", which can be found in one or both canals.[3]

According to Cooke & Cox (1979) it was difficult to detect C-shaped canals on the preoperative radiograph. So, in current study an in-vitro method was selected to investigate the C-shaped canal in mandibular second molars. All root canals that conformed to the general structure of a 'C' and occurred in a C-shaped root were described as C-shaped root canals.[3]

The classification system of canal types described by Meltonet al. (1991) was used to describe the canal system in C-shaped roots. In type I canal, a single canal is present from orifices to the apex; this has been described as a true C-shaped canal.[4]

Previously reported differences in the root-canal anatomy of mandibular second molars may be due to difference in the study population from which the teeth were chosen. In Caucasian population the two rooted mandibular second molars were predominantly seen in different studies by Ainamo & Loe (1968), Tamse & Kale (1981),Vertucci[13](1984) and Weine et al.[6](1988), whereas in Asian or Mongoloid population the higher number of single-rooted mandibular second molars were found by Kotoku[11](1985). But In present study 18% of mandibular teeth were found single-rooted, 80% were double-rooted where as only 2% were having three roots. A radiographic study[6] by Weine et al. (1988) reported three single-rooted specimens one to have a single canal and two to have C-shaped, and photographs from another study[14] by Walker RT (1988) of selected specimens clearlyshowed the complex anatomical characteristic of single-rooted specimens. In the current investigation, a variety of canal types was found, the total 13 teeth out of 100 found with C-shaped configuration from which 3 were of category I & II respectively and 07 were category III. Manning[15] (1990) also reported that category III systems occurred most frequently, which is in agreement with this study.

Manning[15] (1990) found that, amongst 19 teeth, three (10%) had true C-shapes. Haddad et al.[8] (1999) reported that true C-shaped canals with a single canal, occurred most frequently.

Melton et al.[4] (1991) reported that the C-shaped canals had various configurations at different root levels; this was particularly true in all category III Canals. The incidence of C-shaped canals in the mandibular second molars, the findings of this study were in good accord with those of other recent studies using various techniques.

In this study the number of the orifices was also observed regardless of their shape at the level of the floor of the pulp chamber out of 100 teeth, 03 had one orifice, 26 had two orifices, 3 orifices were seen in 66 teeth and 5 teeth had 4 canals.

The frequency obtained in this investigation (10.6%)lies between the 31.5% frequency reported by Yang et al.[7](1988) and the 2.7% frequency reported by Weine et al.[6](1988).The geographical position of Pakistan in particular and the south East, in general, may be the explanation for this phenomenon. However, further studies would be necessary to confirm this phenomenon.

CONCLUSION

The present study demonstrated that mandibular second molar teeth have variations in terms of number of roots, number of canal orifices and canal morphology. Therefore it should not be assumed that these teeth always have two-roots and three canals. The overall prevalence of C-shaped was found 13% in the local population. The difference to other studies may be attributable to racial differences and study model.

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