



Morphological Variations Of Root Canals In Mandibular Second Premolars In Bengali Sub-Population

Dr. Saquib Razi, Prof(Dr.)Priti D Desai, Sabyasachi Charkraborty, Prof(Dr.) Promita Mazumdar
Guru Nanak Institute of Dental Sciences and Research, Panihati, Kolkata

***Corresponding Author:**

Dr. Saquib Razi

Guru Nanak Institute of Dental Sciences and Research, Panihati, Kolkata

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Abstract

Objective: To study the root and root canal morphology of mandibular premolars in a Bengali sub-population using cone-beam computed tomography (CBCT).

Methods: 58 CBCT images were obtained from the Department of Oral Medicine and Radiology of the Dental College and Hospital. A total of 58 mandibular second premolar teeth were analyzed by two observers. The number of roots and the presence of apical delta were examined. Differences in the incidence of canal shape and lateral canals between gender and tooth position (right/left) were compared using Chi-square test. The level of statistical significance was set at 0.05.

Results: All the teeth showed a single canal in 35 male patients and 23 female patients, 6 teeth had lateral canals. No apical delta was evident from the CBCT scans.

Conclusion: The Bengali sub-population under consideration has complex root canal morphology in mandibular premolar teeth with the maximum presence of single canal.

Keywords: Cone-beam computed tomography, mandibular premolar, root canal morphology, apical delta

Introduction

A comprehensive knowledge of external and internal anatomy of human teeth is essential for many dental procedures. The human mandibular premolars are well known for their difficulties in endodontic technique as it pose great challenge for endodontic treatment as a result of the variations in its root canal morphology. An appreciable range of variations with relatively high incidence of abnormalities have been reported for this type of teeth ^[1]. Furthermore the variations in the root canal morphology have been closely linked to the failures of nonsurgical root canal treatment and high frequency of endodontic flare-ups.

The proper knowledge of the root canal morphology is very important for the application of correct technique for shaping and cleaning the radicular canal of teeth. This provides the favourable outcome for the root canal treatment. The internal dental

anatomy is mostly studied using tooth clearing, sectioning, radiography, in vitro endodontic access through radiographs and instruments, and with magnification. Previous studies on mandibular second premolars have used methods such as hard tissue section, root canal staining and clearing, and micro-CT scanning to observe the internal anatomy and morphology of the teeth. More recently, Cone beam computed tomography (CBCT) has been used as reliable diagnostic tool. It provides high quality images, ability to produce a nondestructive 3D views and reduced exposure compared to conventional CT ^[2]. The mandibular second premolar is single rooted teeth like the mandibular first premolar. The root is described as flat or convex on its mesial surface, while the distal surface often has longitudinal developmental depression. A cross section of the root is usually ovoid in shape. The overall average length

is 22.5 mm with an average crown length of 8 mm and an average radicular length of 14.5 mm. Studies on the radicular morphology of the mandibular premolars have shown that there is considerable variation in the number of canals and roots found in these teeth as reported by Barbizam *et al.* in 2004.^[3] The purpose of this study is to investigate the root and canal morphology in mandibular second premolars in Bengali population using CBCT.

Materials and methods:

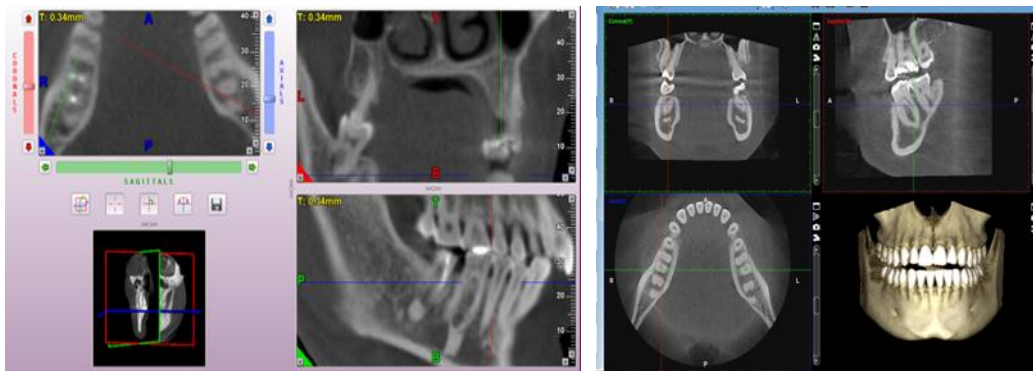
Patient selection:

58 mandibular second premolar teeth were examined in pre-existing CBCT scan taken for other pathological reasons from the archives of Department of Oral Medicine and Radiology of the Dental College and Hospital.

CBCT scan:

In all those premolars presence of the number of roots, lateral canals, apical delta and its distance from the root apex, and canal shape were examined with the use of CBCT and results were recorded.

Fig.: CBCT image of the lower jaw



Statistical analysis

The collected data was tabulated in a spreadsheet using Microsoft Excel 2019 and then statistical analysis was carried out using IBM SPSS Statistics for Windows, Version 26.0. (Armonk, NY: IBM Corp). Incidence of canals according to the gender, canal shape and status of presence of lateral canals

were expressed in terms of frequencies and percentages. Chi square (χ^2) test was used to compare the differences in the incidence of canal shape and lateral canals between gender and tooth position (right/left) respectively. The *P*-value of 0.05 was considered as the level of statistical significance.

Results

Table: Configuration of Root Canal System in Mandibular Second Premolar Based on Location and Gender

Variables	Left			Right			Total number of teeth (N=58)
	Females (n=13)	Males (n=18)	Number of teeth (n=31)	Females (n=10)	Males (n=17)	Number of teeth (n=27)	
Shape of Canal							
Oval	11(84.6)	17(94.4)	28(90.3)	9(90)	13(76.5)	22(81.5)	50(86.2)*
Round	2(15.4)	1(5.6)	3(9.7)	1(10)	4(23.5)	5(18.5)	8(13.8)
Status of Lateral Canals							
Present	0(0)	3(16.7)	3(9.7)	1(10)	2(11.8)	3(11.1)	6(10.3)

		[2M, 1M+D]	[2M, 1M+D]	[1M]	[1M,1D]	[2M,1D]	[4M,1D,1M+D]
Absent	13(100)	15(83.3)	28(90.3)	9(90)	15(88.2)	24(88.9)	52(89.7)*

Values expressed in terms of frequencies (percentage)

N: Total number of teeth; n: teeth per group

M: mesial, D: distal, M+D: both mesial and distal*:analyzed by χ^2 test; $P < 0.001$

Of the 58 mandibular second premolars, 50(86.2%) teeth had oval-shaped, while 8(13.8%) teeth had round canals in cross-section. A total of 6(10.3%) teeth showed the presence of lateral canals amongst which 4 teeth had mesially placed lateral canals, 1 tooth had distally placed lateral canals and 1 tooth had lateral exits both mesially and distally. The higher incidence of oval shaped canals than round canals and the lower incidence of presence of lateral canals were statistically significant ($P < 0.001$). No gender difference was found in the frequency of canal shape ($P = 0.893$) and lateral canals status ($P = 0.224$) respectively. Also, no significant difference was found in the frequency of teeth according to the position (right/left) with canal shape ($P = 0.33$) and status of lateral canals ($P = 0.858$) respectively. The data has been presented in Table and Figure No. 2.

Figure: Bar Graph showing percentage distribution of teeth according to Shape of Canal cross-section in Mandibular Second Premolar Based on Location and Gender

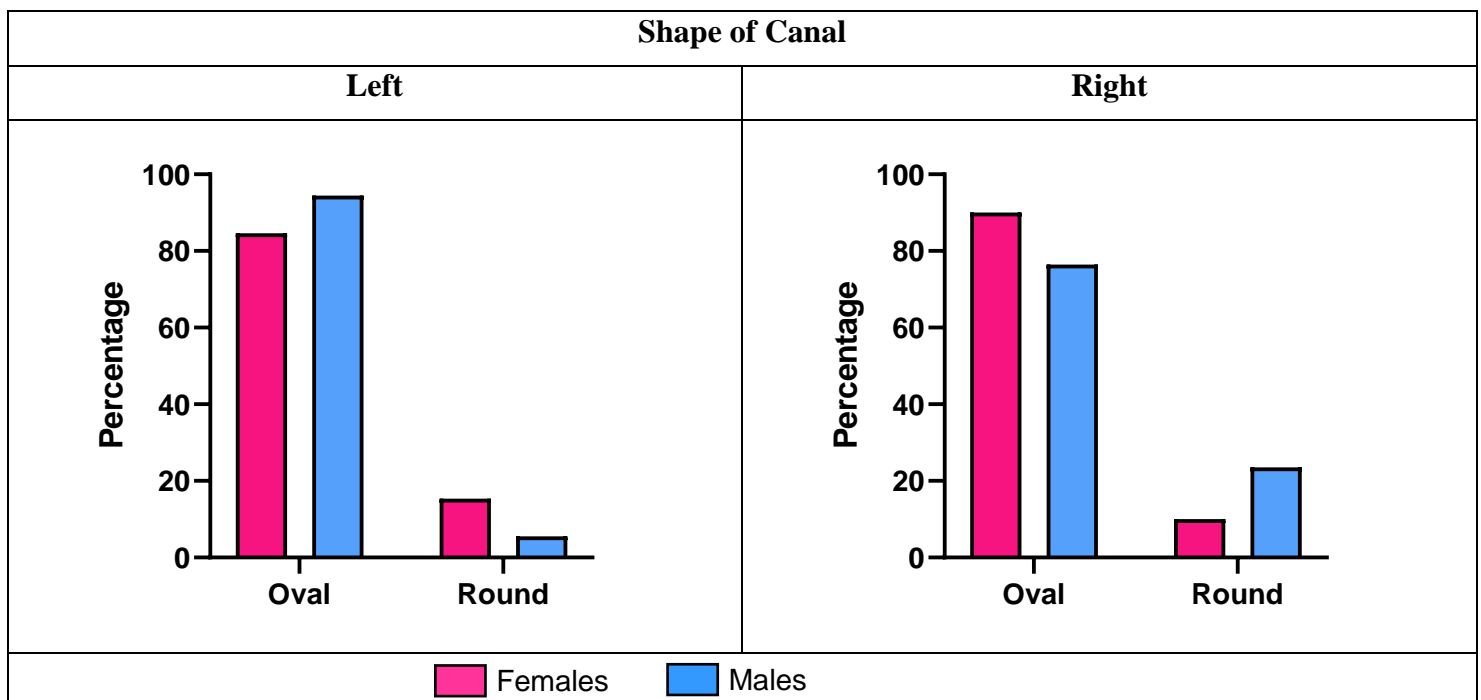


Figure: Bar Graph showing percentage distribution of teeth according to Status of Lateral Canals in Mandibular Second Premolar Based on Location and Gender

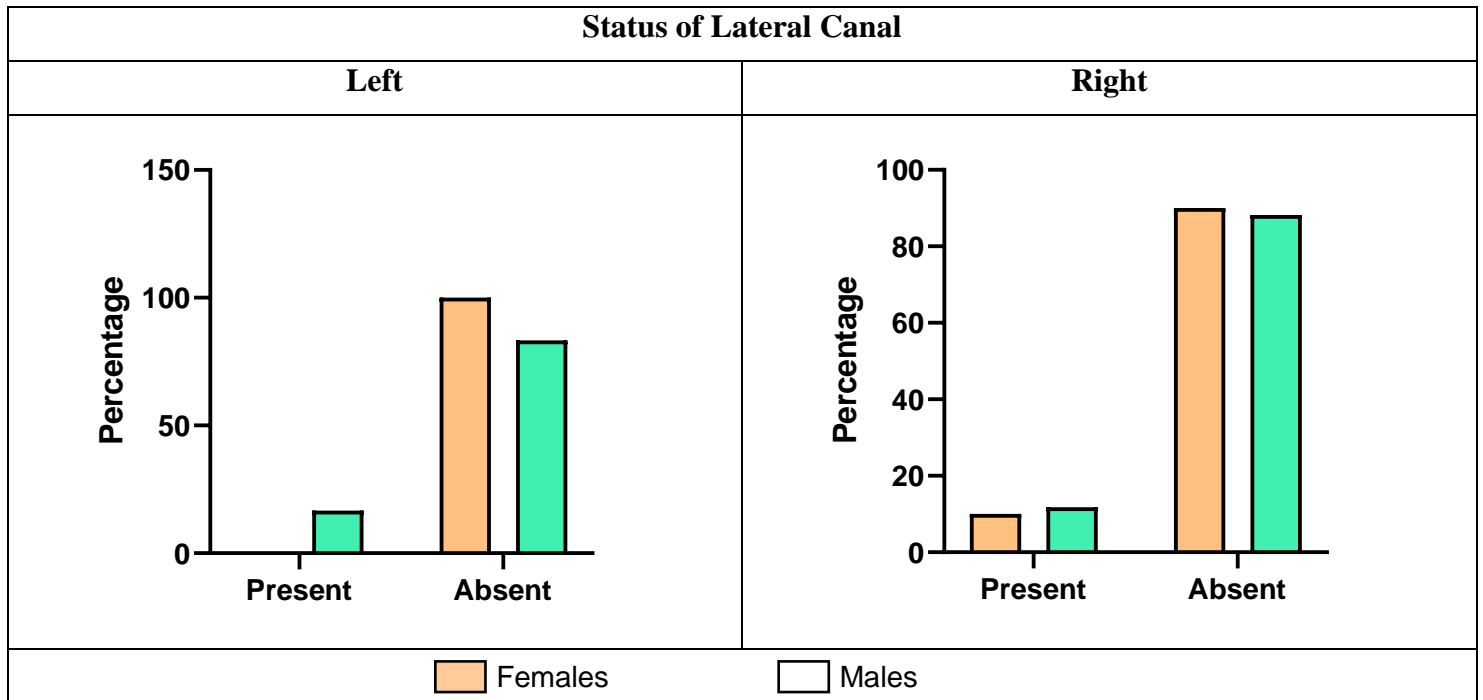
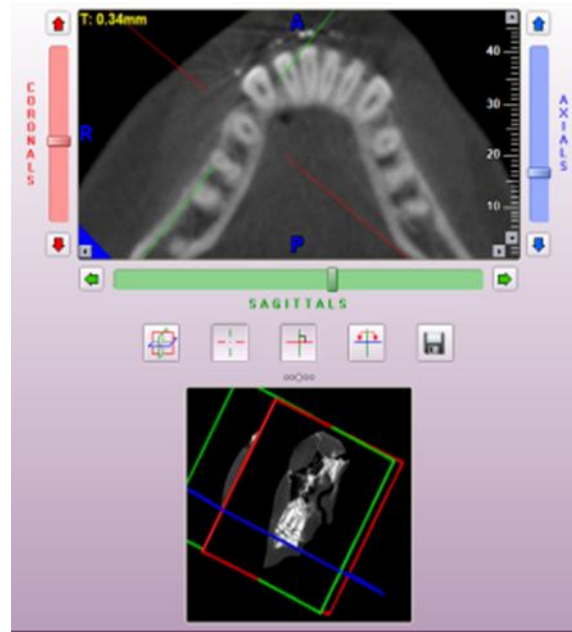


Fig.: CBCT image of the premolar tooth



Fig.: CBCT image of the lower jaw**Discussion:**

Proper location, cleaning and shaping of root canals is very important for the success of non-surgical endodontic treatment of tooth along with its proper filling. Therefore, it is essential for clinicians to have knowledge about root canal configurations, particularly because their morphology varies between races and even between individuals with the same racial background. Studies on the radicular morphology of the mandibular premolars have shown that there is a considerable variation in the number of canals and roots found in these teeth as reported in various other literatures.

Youssef A Algarni *et al.* (2019) ^[4] investigated the root and root canal morphology of mandibular first premolar among Saudi Arabian subpopulation. Cone-beam computed tomography images of Mandibular first premolar were taken from 166 patients. The mandibular first premolar (n = 216) distributed as 120 teeth in female and 96 teeth in male. Out of the 120 teeth examined in female groups one canal was seen in 95 (79.2%) teeth, two canals in 19 (15.8%) teeth and three canals in 6 (5%) teeth. Bolhari *et al.* ^[5] reported mandibular premolars with a single canal at 91.24 and 8.75% with more than one canal. The occurrence of a single canal in the mandibular first premolar was reported from 54 to 88.5%, whereas multiple canals were reported from 11.5 to 46%. ^[6]

Xuan Yu *et al.* ^[7] evaluated the root and canal morphology of mandibular premolars in a western Chinese population using CBCT scanning. The sample included 149 CBCT images comprising 178 mandibular first premolars and 178 second premolars. The tooth position, number of roots and canals, and canal configuration according to Vertucci's classification were recorded. The results showed that 98% of mandibular first premolars had one root and 2% had two roots; 87.1% had one canal, 11.2% had two canals and 0.6% had three canals. Several methodologies have been proposed for the evaluation of root canal anatomy.

The use of conventional radiographs at different angles is another often-used technique but it does not provide detailed information. The clearing technique is frequently used but can only be applied after extraction of tooth. According to Alfawaz *et al.* 2018 recently, the use of CBCT has been considered an excellent clinical tool for this purpose due to its three-dimensional evaluation of the tooth anatomy. ^[8]

The mandibular first premolar is typically a single rooted tooth. Although Trope *et al.* in 1986 reported two, three, and four- rooted variations of the teeth that are rare. Approximately 24% of mandibular premolars demonstrate two or more canals. ^[9]

In this present study, CBCT was used to evaluate the root canal morphology and to determine the presence

of apical delta in the south Bengal population. The most common finding was the presence of single root canal in both the right and left quadrants. And it was observed that 39 second premolars (100%) were found with single root canal. Four lateral canals (10.25%) were found with 3 canals in the mesial direction and one canal in the distal direction. The limitation in this in vitro study is the examination of images that are scanned by CBCT are often of poorer resolution that limits studies of detailed structures. Further studies with micro CTs are required in this manner for the observation of other variations and anomalies of the root canals.

Conclusion:

Within the limitation of the study, it can be concluded that cone beam computed tomography is a useful tool in the evaluation of morphology of the root canal in the mandibular second premolars.

The mandibular second premolars in the south Bengal population exhibited more commonly single root canal in both the quadrants. The presences of lateral canals were very few as has been observed.

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