

## Various Root Canal Configurations Of The First And Second Mandibular Premolars In A South Indian Population

Research Article

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### Abstract

**Aim:** To evaluate the various root canal configurations of first and second mandibular premolars in a south Indian population. **Background:** The first and second mandibular premolar roots and canals may have a wide range of morphologies. Endodontic care of mandibular premolars is difficult due to their varying morphology. Differences in root canal anatomy have been attributed to nonsurgical root canal treatment failures and a high incidence of endodontic flare-ups. Hence, an in-depth examination of root canal configuration is needed to avoid endodontic obstacles.

**Materials and Methods:** The current study is an institutional based retrospective study performed at Saveetha dental college, Chennai. A total of 400 subjects who reported symptomatic apical periodontitis of mandibular premolars were chosen for the study in a total of 49,832 subjects screened for the data. All the case records and treatment records were obtained from the patient management software known as DIAS. The statistical analysis was performed using IBM SPSS (Version - 26).

**Results:** The results showed that the most common root canal configuration was Type I, followed by Type V in first premolar and Type II in second mandibular premolar. Chi square tests were performed between gender to prevalence of various canal configuration. Statistical significance was set at  $p < 0.05$ . A significant correlation was observed in the results.

**Conclusion:** Within the limitations of the study, the majority of mandibular premolars have a single canal, the presence of two or three canals is not uncommon; thus, clinicians should always presume that these teeth have two or more canals when performing endodontic therapy.

**Keywords:** Vertucci's Canal Configuration; Mandibular Premolars; CBCT; Radiovisiography; Retrospective Study.

### Introduction

For dental procedures, a thorough understanding of the external and internal anatomy of human teeth is needed. The human mandibular first premolars are well known for their difficulties in endodontic technique, as the differences in root canal morphology present a significant obstacle for endodontic care.[1]

The first and second mandibular premolar roots and canals may have a wide range of morphologies. Endodontic care of mandibular premolars is difficult due to their varying morphology.[2] The mandibular premolars are difficult to endodontically treat due to differences in canal anatomy. This type of tooth has been stated

to have a wide range of variations as well as a high occurrence of abnormalities. Additionally, differences in root canal anatomy have been attributed to nonsurgical root canal treatment failures and a high incidence of endodontic flare-ups.[2, 3]

The anatomy of the root canal system is complicated. It differs not only between separate teeth but also within a single tooth between individuals. Extra canals, anastomosis, and other irregularities are common in root canal anatomy; extra canals, anastomosis, and other irregularities are common. Different ethnic groups have different root anatomy and root canal morphology. An in-depth examination of root canal configuration is needed, with a focus on different races or regions.[4-6]

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Radiography, clearing techniques, direct examination with a microscope, 3D reconstruction, and macroscopic sectioning are all popular methods for studying root canal anatomy. [7] Superimposition is an issue with traditional radiography, and it often results in a two-dimensional image of a three-dimensional structure. CBCT provides images in the axial, sagittal, and cross-sectional planes, as well as images of panoramic and three-dimensional reconstructions and hence considered the best for assessing canal morphology. [8-10]

The aim of this study was to investigate the root canal morphology of mandibular first and second premolars in a south indian population, its correlation to gender and to compare the findings with existing canal morphology classifications. Our research experience has prompted us in pursuing this survey [11-20].

### Materials And Methods

The current study is an institutional based retrospective study performed at Saveetha dental college, Chennai. The necessary approvals were obtained from the Institutional Ethical committee. All the data collected was cross verified by an examiner to avoid any missing case- records.

A total of 400 subjects who reported symptomatic apical periodontitis of mandibular premolars were chosen for the study in a total of 49,832 subjects screened for the data. Root canal morphology assessment was made using radiovisiography and CBCT. All the data collected was formatted and tabulated using Microsoft Excel (Version - 2020). All the case records and treatment records were obtained from the patient management software known as DIAS. The dependent variable was the presence of the number of canals. The statistical analysis was performed using IBM SPSS (Version - 26). Chi square test was applied and level of

significance was set at  $p < 0.05$ .

### Results

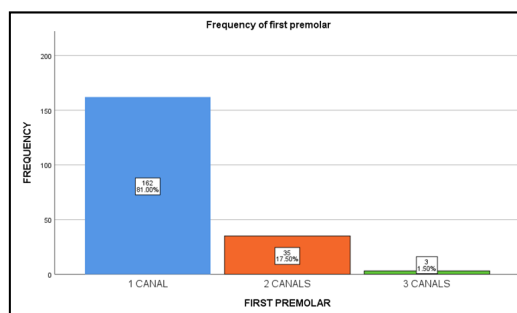
Figures

### Discussion

The root and root canal morphology of teeth is subject to a great deal of variance in the literature, and the human mandibular premolars are no exception. [21] Overlooked root canals are the leading cause of endodontic failure. Extra roots or canals in mandibular premolars pose a significant endodontic problem. An essential prerequisite for endodontic performance, in addition to diagnosis and treatment preparation, is knowledge of traditional root canal morphology and its frequent variations. A thorough understanding of the morphology of the root canal system, as well as the careful interpretation of angulated radiographs, and the use of CT to evaluate the root canal system in greater detail and accuracy, including planification of an access cavity, a thorough initial exploration of pre-curved and low-gauge files, and the use of magnification and illumination in the procedure, are all important. [21, 22]

The root canal system of mandibular first premolars was found to be primarily Type I (81%) in the current study (Single canal extends from pulp chamber to apex). Type I canal system was found in 70% of Vertucci's patients, 72% of Velmurugan & Sandhya patients, and 67.2% to 86.3% of Zillich & Dawson patients [4, 23]. In contrast to Vertucci's 0%, Velmurugan & Sandhya's 6%, and Rahimi et al.'s 5.6%, the Type II canal system (two separate canals exit the pulp chamber and merge the apex of teeth to form one canal) was found in 0.5% of teeth [24, 25]. 1% of teeth had a Type III Canal System (one canal leaves the pulp chamber, divides into two canals in the root, and then merges into one and exits), which was close to Vertucci's findings of 4% and Vel-

**Figure 1:** Shows the frequencies of canal variations in mandibular first premolars. X axis represents the canal variation and Y axis represents the number of subjects. 81% had 1 canal (blue), 17.5% had 2 canals (orange) and 1.5% had 3 canals (green). Majority of the subjects presented had 1 canal.



**Figure 2:** Shows the frequencies of canal variations in mandibular second premolars. X axis represents the canal variation and Y axis represents the number of subjects. 95.5% had 1 canal (blue) and 4.5% had 2 canals (orange). Majority of subjects had 1 canal.

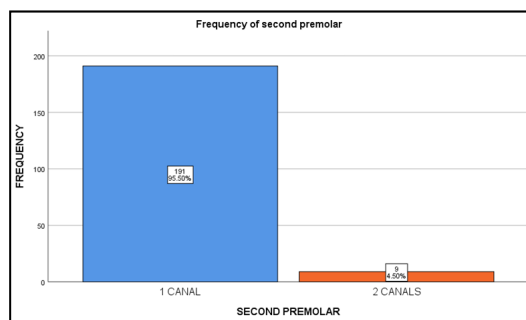


Figure 3: Shows the frequencies of gender groups in the recorded data presenting with canal variations in mandibular first premolars. X axis represents the gender groups and Y axis represents the number of patients. 63.50% were Male ( blue), and 36.50% were females ( orange). Majority of the subjects were male.

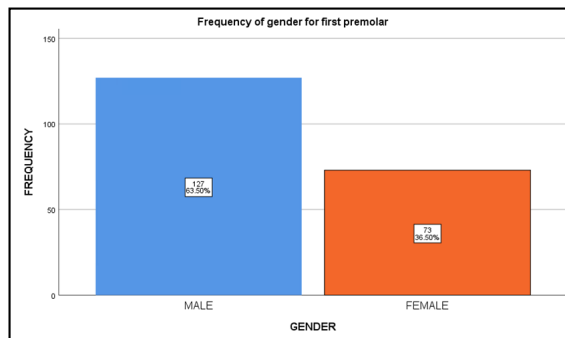


Figure 4: Shows the frequencies of gender groups in the recorded data presenting with canal variations in mandibular second premolars. X axis represents the gender groups and Y axis represents the number of patients. 41% were Male ( blue), and 59% were females ( orange). Majority of the subjects were female.

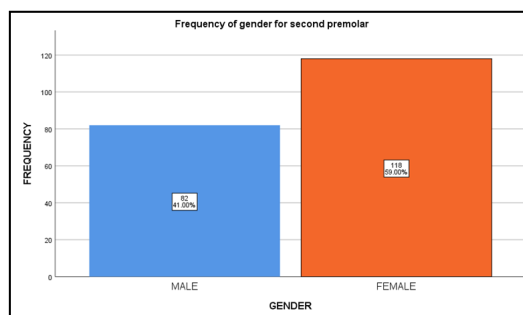


Figure 5: Shows the association between gender and the number of canals in mandibular first premolars. Blue represents male subjects and red represents female subjects. 54% male and 27% female subjects had 1 canal configuration. 9.5% of male and 8% of females had 2 canal configurations and 1.5% female subjects had 3 canals. p value obtained was 0.02(p<0.05) making the correlation significant.

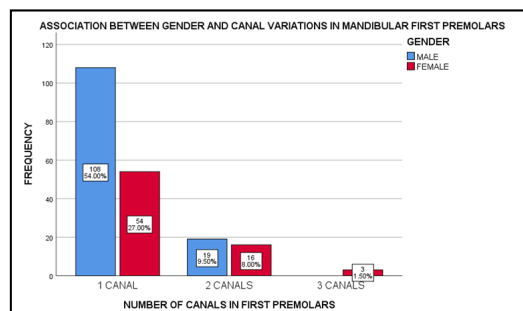
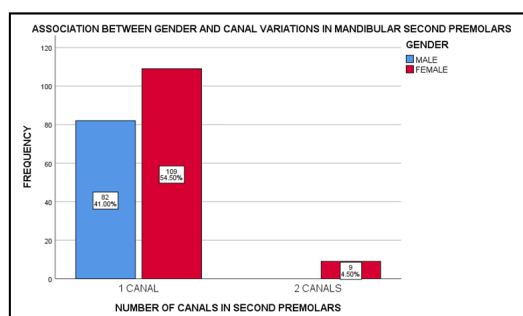


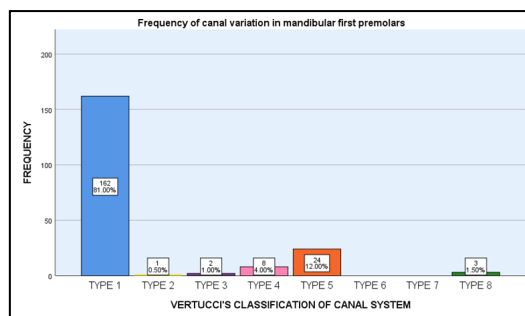
Figure 6: shows the association between gender and the number of canals in mandibular second premolars. Blue represents male subjects and red represents female subjects. 41% male and 54.50% female subjects had 1 canal configuration. 4.5% of female subjects had 2 canal configuration. p value obtained was 0.01(p<0.05) making the study significant.



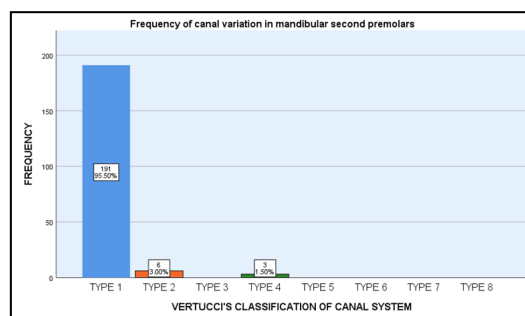
murugan & Sandhya's findings of 3%. The Type IV canal system (two separate canals extending from the pulp chamber to the apex) was found in 4% of mandibular first premolars, according to Vertucci (1.5%), Velmurugan & Sandhya (10%), and Rahimi et al. (22%). Type V Canal system (one canal leaves pulp chamber, divides short of apex into two) was found in 12% of teeth, Vertucci found it in 24% of teeth, and Velmurugan & Sandhya found it in 8% of teeth. In 0.72 % of teeth, the Type VI canal

system (two canals leave the pulp chamber, merge in the root, and then split again short of the apex to exit as two distinct canals) was discovered. None of the teeth had canals of type VII (one canal leaves the pulp chamber, divides and rejoins in the root, and eventually divides into two canals short of the apex). Type VIII (three separate canals stretch from the pulp chamber to the apex) was discovered in 1.50% of the mandibular first premolars.[4, 24] According to Zaatari et al., 95.3% of mandibular second premolars

**Figure 7:** Shows the frequencies of root canal variations in mandibular first premolars. X axis represents vertucci's classification groups and Y axis represents the number of patients. 81% were type 1 (blue), 0.5% were type 2 (yellow), 1% were type 3 (purple), 4% were type 4 (pink), 12% were type 5 (orange), 0% of type 6, 7 and 1.50% of type 8 (green). Majority of the subjects had type 1 configuration followed by type 5 in mandibular 1st premolars.



**Figure 8:** Shows the frequencies of root canal variations in mandibular second premolars. X axis represents vertucci's classification groups and Y axis represents the number of patients. 95.50% were type 1 (blue), 3.0% were type 2 (orange), 1.5% were type 4 (green), and 0% of type 3, 5, 6, 7, 8. Majority of the subjects had type 1 configuration followed by type 2 in mandibular second premolars.



have one canal, while 4.7 % have two. Geider et al. found that 86.6 % of mandibular second premolars have one canal and 13.4% have two canals in France. Sert and Bayirli discovered that 71% of mandibular second premolars have one canal and 29% have two canals in Turkey [1]. Bolhari et al. reported in 2013 that in the Tehran population [26], 91.24 percent of root canals were listed as type I, while 8.86 percent went to other categories. 217 teeth were evaluated using radiography and fuchsin staining. Sobhani et al. found nearly identical results in a study conducted among the Tehran population. CBCT was used to examine 611 teeth in this study.[1, 6] Rahimi et al. examined 137 teeth using stereomicroscopy in 2009 and 103 teeth using ink injection in 2007. Both studies were performed in Tabriz. There are, however, several distinctions in prevalence. In our current study on mandibular second premolars, we found that 95.5% had Type I root canal system, followed by 3% Type II and 1.5% Type III canal system.

The difference between the incidence of I, II, III, IV, V canal system in this study and those recorded by Vertucci, Velmurugan&Sandhya, and Rahimi et al. may be attributed to racial differences since this study was conducted on an South Indian population, while Vertucci studied a Caucasian population, Rahimi et al. studied an Iranian population, and Velmurugan&Sandhya studied a South [4, 24, 25]

The association between gender and the number of canals in mandibular first premolars. 54% male and 27% female subjects had 1 canal configuration. 9.5% of male and 8% of females had 2 canal configurations and 1.5% female subjects had 3 canals. p value obtained was 0.02 (p<0.05) hence making the correlation significant that 2 canals are found nearly equal in both genders and 3 canals were more frequently found in females.

The association between gender and the number of canals in mandibular second premolars. 41% male and 54.5% female sub-

jects had 1 canal configuration and 4% female subjects had 2 canal configuration. p value obtained was 0.02(p<0.05) hence making the correlation significant that 2 canals are found significantly more in females.

### Conclusion

While the majority of mandibular premolars have a single canal, the presence of two or three canals is not uncommon; thus, clinicians should always presume that these teeth have two or more canals when performing endodontic therapy. The results of this research, as well as previous studies, show significant ethnic differences in the internal canal morphologies of human mandibular premolars; additionally, since the studies were conducted in different geographic areas, the findings confirm the effect of genetic factors on the internal canal morphologies of human teeth.

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