

FREQUENCY OF SECOND CANAL IN MAXILLARY SECOND PREMOLARS (EX-VIVO STUDY)

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ABSTRACT

The objective was to determine the frequency of second canal in extracted maxillary second premolars. This was an in vitro study conducted at the Department of Operative Dentistry, Liaquat University of Medical & Health Sciences, Jamshoro from October 2011 to March 2012.

This study included two hundred extracted human maxillary second premolars. The pulp chambers were accessed with round bur in a high speed air turbine, and they were irrigated with 2.5% sodium hypochlorite solution for 12 hours to dissolve the pulp tissues, then rinsed under running tap water for 2 hours and dried overnight. The dye was introduced coronally and flooded throughout the pulp space by vacuum suction apically. Teeth were then decalcified in 5% nitric acid solution for five days. Eventually teeth were made clear by dipping in methyl salicylate and examined under operating microscope under 7.5 x magnification for the frequency of second canal.

Results showed that the frequency of second canal of the maxillary second premolars is 37% (74/200). Chi-square test was used to evaluate the results. It was concluded that dentists must always look for the second canal during endodontic treatment of the maxillary second premolars.

Key Words: Second canal in maxillary second premolar, Access cavity.

INTRODUCTION

The familiarity of internal morphology of tooth plays a significant role for the success of endodontic treatment.¹ For achieving success in endodontic treatment, dentist must know normal internal anatomy of a tooth as well as its possible different internal morphological variations.² The main objective of the endodontic treatment is thorough shaping and cleaning of all pulp spaces and its complete obturation with an inert filling material. The failure in recognition of the canal, leave it untreated. The presence of an untreated canal is a reason for failure.³

Diagnostic measures such as multiple pre-operative radiographs, examination of the pulp chamber floor with a sharp explorer, toughing of grooves with ultrasonic tips, staining the chamber floor with 1% methylene blue dye, performing the sodium hypochlorite 'champagne bubble' test and visualizing canal bleeding points are important aids in locating root canal orifices.⁴

There are many factors i.e. the various pulp cavity configurations, the number of root canals, the number of roots, the direction and longitudinal depressions of the roots, and the difficulties in visualizing the apical limit by radiographs, make endodontic treatment of the maxillary second premolars challenging for dentist.⁵

A detailed research was performed by Vertucci on the canal morphology of different teeth, in his study of 200 extracted maxillary second premolars, he found that 24% of the maxillary second premolars had second canal.⁶ In another Indian study of 200 extracted maxillary second premolars, 35.4% had second canal.⁷ The finding of another study showed second canal in 58% cases.⁸

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These studies were performed on teeth of North American, 3 Indian, 7 Turkish, 9 and Chinese 10 populations; relating that different races and geographical areas show different canal morphology. There is no local published report undertaken, and the rationale of this study was to conduct a study recording the frequency of second canal of the maxillary second premolars in local population, and to compare them with other studies. This could help in successful treatment planning and endodontic treatment of the maxillary second premolars in local population.

METHODOLOGY

A total of 200 extracted human maxillary second premolar teeth were collected from the Dental Outpatient's Department of Liaquat University of Medical and Health Sciences Hospital, Hyderabad / Jamshoro, dental clinics and hospitals in district Hyderabad from October 2011 to March 2012. This included the time taken to collect and analyze the data. No information was collected regarding reason for their extraction or the age and gender of the patients. Teeth with deep caries, metallic restorations, incompletely formed roots, and fracture were excluded from this study. The teeth were kept in 10% formalin after removing stains and calculus using an ultrasonic scaler. The access cavities were prepared with No. 2 round bur in a high speed air turbine (Foshan, China). Then pulp chamber was irrigated with 2.5% sodium hypochlorite solution for 12 hours to dissolve pulp tissues and soaked in an ultrasonic bath for 20 minutes. The teeth were then bathed under running tap water for 2 hours and dried overnight. For staining of teeth, with a 27 gauge needle methylene blue dye was injected into the root canal spaces coronally, assisted by vacuum suction apically. After drying the teeth with air, then teeth were decalcified in 5% nitric acid solution for five days. The teeth were kept in fresh acid solution everyday and the end point of decalcification was determined by periodic radiographs. The traces of acid solution were removed by bathing under running water and dried. Then teeth were dehydrated using increasing concentrations of ethanol (70%, 95%, 100%) for 1 day. Lastly the teeth were made clear by dipping in methyl salicylate. The cleared teeth were examined under operating microscope under 7.5 x magnification for the presence of the second canal.

RESULTS

Data were analyzed in Statistical Package for Social Sciences (SPSS) version-17. Frequencies and percentages were calculated for second canal. Chi-square test was used to interpret the results of the study.

Two hundred extracted human maxillary second premolars were included in this study. Out of 200, 62% showed single canal, 37% showed second canal, and 1% showed three canals of the total sample (Table 1).

DISCUSSION

Variations in root canal system create a lot of problems during endodontic treatment.¹¹ An understanding of the architecture of the root canal system prior to endodontic treatment is an essential prerequisite for the successful endodontic treatment. The failure in locating the canal is major reason of recurrence of endodontic infection after obturation.^{12,13}

Maxillary second premolar is one of the most difficult tooth to be treated endodontically.¹⁴ Various studies^{5-10,15-20} have been conducted and reported variations in number of root canals in the maxillary second premolar teeth. The findings of studies^{8,15,17} report that the frequency of second canal range from 28% to 58.6% in the maxillary second premolars.

Different methodologies have been used to study the root canal morphology of the permanent maxillary second premolars including radiography,²¹ decalcification and clearing^{3,22,23}, direct observation with microscope,^{24,25} sectioning and macroscopic observation,²⁶ and computer tomography.²⁷ All above methods may have shortcomings. In the present study, decalcification and clearing technique was used to determine the frequency of second canal in maxillary second premolars.

In 1984, Vertucci FJ6 found second canal in 24% of 200 maxillary second premolars using clearing technique. The finding of an in vitro study conducted in Brazilian population by Pecora JD and others⁵ (1992) using clearing technique revealed that second canal was found in 32.4% of 300 maxillary second premolars. Calışkan MK and others¹⁸ (1995) and Sert S and Bayirli

TABLE 1: FREQUENCY OF SECOND CANAL IN PERMANENT MAXILLARY SECOND PREMOLARS (N=200)

Total No. of teeth	Single Canal		Second Canal		Three Canals	
	No. of teeth	Percent	No. of teeth	Percent	No. of teeth	Percent
200	124	62%	74	37%	2	1%

GS9 (2004) conducted in vitro studies in Turkish population using clearing technique and reported second canal in 28% and 36% of total 100 and 200 maxillary second premolars respectively. The finding of another in vitro study conducted by Kartal N and others¹⁷ (1998) using clearing technique revealed that 44.4% had second canal in total 300 sample size.

Shahi S and Sharifzadeh R¹⁹ (2007) performed an in vitro study using clearing technique and found second canal in 50% of total 138 maxillary second premolars. In 2009, an in vitro study was performed by Weng XL and others¹⁰ in Chinese population using clearing technique and reported 72.3% of the maxillary second premolars had second canal. Jayasimha Raj U and Mylswamy S⁷ (2010) investigated two hundred extracted maxillary second premolar teeth using clearing technique. The finding of study revealed that second canal was found in 35.4% of total sample size. Bellizzi R and Hartwell G⁸ (1985), Chima O¹⁶ (1997), and Sardar KP and others²⁰ (2007) conducted in vivo studies, and reported second canal in 58.6%, 71.5%, and 57% of total sample size respectively.

The finding of present study revealed that second canal was found in 37% (74 out of 200) of cleared maxillary second premolar teeth. The frequency of second canal in the maxillary second premolars in this study is higher than the findings of the studies conducted by Vertucci FJ,⁶ Pecora JD and others,⁵ Calışkan MK and others,¹⁸ Sert S and Bayirli GS,⁹ and Jayasimha Raj U and Mylswamy S,⁷ but lower than Bellizzi R and Hartwell G,⁸ Chima O,¹⁶ Kartal N and others,¹⁷ Shahi S and Sharifzadeh R,¹⁹ Sardar KP and others,²⁰ and Weng XL and others.¹⁰

The high frequency with which a second canal was found leads us to believe that the second canal is a very frequently occurring normal variation in the permanent maxillary second premolars, therefore every effort should be made to locate second canal until proven there is only single canal.

Several factors are linked to differences in the results of the conducted studies such as study design (in vitro versus in vivo), classification systems, sample size, racial divergence, technique of canal identification (sectioning, clearing, radiographic examination), ethnic background of tooth sources and patient's age.²⁸

For the success of endodontic treatment, a comprehensive knowledge of root and canal morphology, detailed interpretation of periapical radiographs, proper access cavity preparation and a detailed exploration of the interior of the tooth are essential prerequisites.³

A correct access cavity preparation is of central importance in localizing the orifices of the root canals. The shape of the floor of the pulp chamber usually indicates the number of canals.²⁹ Usually; the outlines of the pulp chamber of a premolar tooth are bilaterally similar in shape of a ribbon. If any one side shows wider mesio-distal width, the one can suspect second canal. When there is only single canal, it is usually located in the center of the access preparation, if not in center then dentist should search second canal on the opposite side. Furthermore, to rule out second canal, a suspected tooth needs modification of the access cavity, better visualization and manual exploring of the pulp chamber with a small size pre-curved file.³⁰

Genetic, developmental and environmental factors play role in variations in the root canal morphology. There is strong need for dentists to be made aware of the frequency of racially determined forms.³¹ Therefore, comprehensive knowledge of root canal morphology is important before endodontic treatment for successful endodontic treatment.¹²

CONCLUSION

Due to possibility of the complex nature of root canal system in the maxillary second premolars, careful evaluation is important before endodontic treatment. Dentists must always look for the second canal during endodontic treatment of the maxillary second premolars in local population.

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