

## Root and Root Canal Morphology of Maxillary Second Premolars in Jammu and Kashmir Population-An Invivo Study.

Dr. Ankush Jasrotia<sup>1</sup>, Dr. Ravinder Kumar Bhagat<sup>2</sup>, Dr. Kanchan Bhagat<sup>3</sup>

<sup>1</sup>(Department of Conservative Dentistry and Endodontics, Indira Gandhi Govt. Dental College and Hospital, Jammu-180001. J&K-India)

<sup>2</sup>(Department of Conservative Dentistry and Endodontics, Indira Gandhi Govt. Dental College and Hospital, Jammu-180001. J&K-India)

<sup>3</sup>(Department of Conservative Dentistry and Endodontics, Indira Gandhi Govt. Dental College and Hospital, Jammu-180001. J&K-India)

Corresponding Author: Dr. Ankush Jasrotia

### Abstract

**Objectives:** The aim of this study was to investigate the number of roots and root canals in the maxillary second premolar in a group of Jammu and Kashmir population.

**Materials and Methods:** A total of 200 patients, 92 female (46%) and 108 male (54%), received root canal treatment of maxillary second premolar from January 2010 to January 2017. The mean age of the patients was 32.7, ranging from 18 to 60 years. The teeth included in the study were examined clinically and radiographically for the number of roots and root canals using magnifying loupes.

**Results:** Out of the total of 200 maxillary second premolars, 110 teeth had one root (55%), 86 teeth had two roots (43%), and four teeth had three roots (2%). Regarding root canal configuration, 57 teeth (28.5%) had one canal with one apical foramina, 53 teeth (26.5%) had two canals leaving the pulp chamber and merging to form a single canal with one apical foramen, 86 teeth (43%) had two canals with two separate apical foramina, and four teeth (2%) had three canals with separate apical foramina.

**Conclusion:** The incidence of two canals (either with one or separate apical foramina) is very high in the maxillary second premolars in Jammu and Kashmir population. Therefore inspection should be done for the presence of second canal or sometimes even third canal whenever endodontic treatment is planned for this tooth.

**Key- Words:** Maxillary second premolar, roots and root canals, apical foramina, magnifying loupes

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### I. Introduction

The main objective of root canal treatment is thorough mechanical and chemical debridement of the entire pulp cavity followed by a three dimensional filling of the entire pulp cavity by an inert filling material<sup>1</sup>. A thorough knowledge of the anatomy of the tooth and morphology of the root canal is essential for the success of root canal treatment<sup>2</sup>. The inadequate knowledge of root and root canal morphology can lead to failure of endodontic treatment<sup>3</sup>. Numerous factors contribute to the variations found in the root canal studies including ethnicity<sup>4,5</sup>, age<sup>6</sup>, gender<sup>7</sup>, and study design (in vitro versus in vivo)<sup>8</sup>. The maxillary second premolars are among the most difficult teeth to be treated endodontically because of its various morphological and anatomical variations.

### II. Materials and Methods

Two hundred patients were done at various hospitals of Jammu and Kashmir for endodontic treatment of maxillary second premolar from January 2010 till January 2017. Preoperative radiographs were taken for evaluation (root morphology, number of canals, and periapical status). The teeth that were included in the study were those teeth that required nonsurgical endodontic treatment. The included teeth were free of root resorption, having no calcifications or open apices. Two periapical radiographs in two angles were taken (parallel and cone shift technique) for evaluation of the number of roots and root canals.

The endodontic procedures undertaken were as follows: All patients were anesthetized with 2% Lignocaine and 1:80,000 adrenaline (Lignox 2% A, Indoco Remedies Ltd. Gujarat). After isolation with rubber dam, an oval access cavity was opened between the cusp tips, being wider bucco-palatally, with sterile high and low speed burs with water coolant. After the contents of the pulp chamber were removed, a sharp endodontic explorer was used to explore the developmental grooves carefully to locate the orifices of the canals, under

magnifying loupes (Carl Zeiss, 3.5X magnification).The canal was negotiated using small size instruments, i.e.6,8,10 (Dentsply/Maillefer). Working length was established with the use of an apex locator (Root ZX, J. Morita Inc, USA). The canals were cleaned and shaped with hand k-files (Maillefer Dentsply, Ballaigues, Switzerland) and rotary files in crown down manner. Canals were irrigated with 5% sodium hypochlorite (Prevest Denpro Ltd. Digiana,,Jammu) and 17% EDTA (Prevest Denpro Ltd.Digiana,,Jammu). Canals were dried using paper points and a master cone radiograph was taken to check the apical fit in all the root canals. Finally all teeth were obturated with Gutta-percha and AH-26 sealer (Dentsply, De Trey, Konstanz, Germany) using warm vertical compaction. The number of roots and root canals in the maxillary second premolars was recorded.

### **III. Results**

A total of 200 patients 92 female (46%) and 108 male (54%) received root canal treatment of maxillary second premolar. The mean age of the patients was 32.7, ranging from 18 to 60 years. Out of the total of 200 maxillary second premolars 110 teeth had one root (55%), 86 teeth had two roots (43%), and one tooth had three roots (2%). Based on Vertucci's classification of root canal morphology, 57 teeth (28.5%) had type I canal configuration (one canal with one apical foramen, Figure 1), 53 teeth (26.5%) had type II (two canal orifices end in one apical foramen, Figure 2), and 86 teeth (43%) had type IV (two canal orifices end in two separate apical foramina, Figures 3 and 4). 4 teeth (2%) had type VIII (three canal orifices end with three separate apical foramina, Figure 5). The incidence of two canals (types II and IV) is 69.5%.



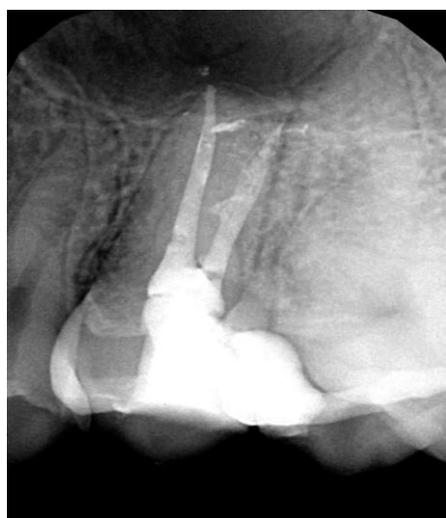
**Figure 1:** One root and one root canal.



**Figure 2:** One root with two canals with one apical foramen.



**Figure 3:** One root with two canals and two separate apical foramina.



**Figure 4:** Two roots with two separate canals and foramina.



**Figure 5:** Three roots with three separate canals and foramina.

Out of the 92 females 48 % of the maxillary second premolar had one root and 52% had two roots. Regarding root canal morphology 25% of the female maxillary second premolar had type I, 19% had type II, and 56% had type IV. Out of the 108 males 38% of the maxillary second premolar had one root, 60 % had two roots, and 2% had three roots. Regarding root canal morphology 17% of the male maxillary second premolars had type I, 15% had type II, 66% had type IV, and 2% had type VIII.

#### IV. Discussion

A thorough knowledge of a common root canal morphology and its frequent variations is a basic requirement for endodontic success<sup>1,2</sup>. Sometimes root canal treatment fails because the clinician fails to detect all the canals present in the tooth<sup>3</sup>. The number of roots and canals of the maxillary second premolar in the literature shows a wide variation<sup>9,10,11</sup>. Maxillary second premolar root canal system demonstrates high variability and it was the only tooth to demonstrate all eight Vertucci's canal configurations<sup>9</sup>. Clinically, diagnostic preoperative radiograph and its careful examination are necessary before starting root canal treatment<sup>12,13,14</sup>. Additional periapical radiographs with cone shift angulations will reveal more adequate information about root canal morphology<sup>15</sup>. In the present study two radiographs were taken to explore the number of roots and root canals and to take the working length of the canals during root canal treatment. One radiograph was taken at right angle and the other with 20°–40° horizontal angle cone shift. Martinez-Lozano et al<sup>15</sup>, found that by varying the horizontal angle of X-ray tube 20°–40°, the number of root canals observed in maxillary first and second premolars coincided with the actual number of canals present. Sardar et al<sup>11</sup>, could identify a significantly higher number of premolars with two canals by using angled radiographs.

Other diagnostic measures that help in locating root canal orifices include adequate access and modification of the outline of the access cavity, exploration of the tooth's interior and exterior, and appropriate magnification and illumination<sup>1,3</sup>.

In this study magnifying loupes were used to help in examination of the pulp chamber floor and to identify and locate the orifices of the root canals. The use of dental loupes and dental operating microscope (DOM) provides the clinician with superior lighting and magnification improving the ability to treat cases and finding extra canals<sup>16</sup>.

Maxillary second premolar is generally considered to have one root and one canal<sup>9,16</sup>. In the present study only 28.5% had one root canal end in one apical foramen (type I, Figure 1). This is at variance with the earlier studies of Vertucci<sup>10</sup> and Kartal et al<sup>17</sup>, in which the maxillary second premolars were reported to have type I in 48% and 48.6%, respectively.

The present study demonstrated high incidence of two canals. The incidence of type II (two canal orifices end in one apical foramen, Figure 2) and type IV (two canal orifices end in two separate apical foramina, Figures 3 and 4) was 26.5% and 43%, respectively. The results of this study do not coincide with earlier studies of Vertucci et al<sup>9,10</sup> and Pécora et al<sup>18</sup> who reported higher incidence of one canal and lower incidence of two canals. The results of our study are in support of Chima<sup>19</sup>, Weng et al<sup>20</sup> and Sardar et al<sup>11</sup> who recorded high incidence of two root canals in the maxillary second premolar.

In the present study just one premolar (2%) had three roots and three canals (type VIII, Figure 5). This low incidence is consistent with other studies where the incidence ranged between 0.3% and 2%<sup>10,17,18</sup>. Three canals should be suspected clinically when the pulp chamber appears to deviate from normal configuration and does not align in its expected bucco-palatal relationship<sup>21,22,23</sup>.

#### V. Conclusion

Clinicians should be very careful when treating maxillary second premolars because of the extreme variability of the anatomy. An awareness of root canal morphology and careful interpretation of preoperative radiographs is necessary for success in endodontic therapy. The incidence of two canals (either with one or separate apical foramina) is very high in the maxillary second premolars in Jammu and Kashmir population. Therefore inspection should be done for the presence of second canal or sometimes even third canal whenever endodontic treatment is planned for this tooth.

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