

**Endodontic treatment of three canal mandibular second premolars with unusual root canal anatomy – A case report of two cases**

<sup>1</sup>Dr. Asim Bikash Maity, Professor Dept. of conservative dentistry & endodontics, Haldia Institute of Dental Sciences & Research, Banbishnupur, Balughata, Haldia, West Bengal 721631.

<sup>2</sup>Dr. Anirban Bhattacharyya, Professor and Head of Department Dept. of conservative dentistry & endodontics, Haldia Institute of Dental Sciences & Research, Banbishnupur, Balughata, Haldia, West Bengal 721631.

<sup>3</sup>Dr. Gayatri Majumder, Assistant Professor Dept. of conservative dentistry & endodontics, Haldia Institute of Dental Sciences & Research, Banbishnupur, Balughata, Haldia, West Bengal 721631.

<sup>4</sup>Dr. Sourav Kirtania, Second year Post Graduate Trainee Dept. of conservative dentistry & endodontics, Haldia Institute of Dental Sciences & Research, Banbishnupur, Balughata, Haldia, West Bengal 721631.

**Corresponding Author:** Dr. Sourav Kirtania, Second year Post Graduate Trainee Dept. of conservative dentistry & endodontics, Haldia Institute of Dental Sciences & Research, Banbishnupur, Balughata, Haldia, West Bengal 721631.

**Citation of this Article:** Dr. Asim Bikash Maity, Dr. Anirban Bhattacharyya, Dr. Gayatri Majumder, Dr. Sourav Kirtania, “Endodontic treatment of three canal mandibular second premolars with unusual root canal anatomy – A case report of two cases”, IJDSIR- May - 2022, Vol. – 5, Issue - 3, P. No. 435 – 443.

**Copyright:** © 2022, Dr. Sourav Kirtania, et al. This is an open access journal and article distributed under the terms of the creative commons attribution non-commercial License. Which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

**Type of Publication:** Case Report

**Conflicts of Interest:** Nil

**Abstract:** Mandibular premolars often exhibit variable, complex and a diverse morphology of roots and root canals. Thorough knowledge of root canal morphology, appropriate assessment of pulp chamber floor and critical interpretation of radiographs are a prerequisite for a long-term successful root canal treatment. This article reports two unusual cases of mandibular premolars with atypical root pattern and multiple root canals which were successfully treated endodontically.

**Keywords:** Mandibular premolar, root canal treatment, three root canals, three roots.

**Introduction**

A clear understanding of the anatomy of human teeth is an essential prerequisite to all dental procedures especially in the case of root canal treatment which deals with management of a tooth’s internal anatomy. A thorough knowledge of the basic root canal anatomy and its possible variations is essential for achieving successful non-surgical

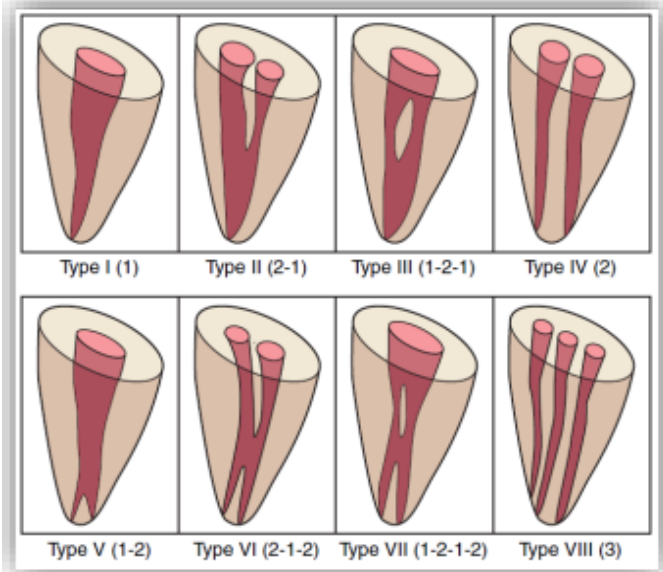


Figure 1: Vertucci's Classification of Root Canal Systems (Types I–Type VIII)

endodontic treatment [1]. The common reasons of failure of a root canal treatment are apical percolation and the presence of microorganisms caused by incomplete cleaning, insufficient canal obturation, and presence of untreated canals [2].

Anatomically lower second premolars are described as teeth with single root and single root canal [3]. They could be challenging at times to treat due to failure

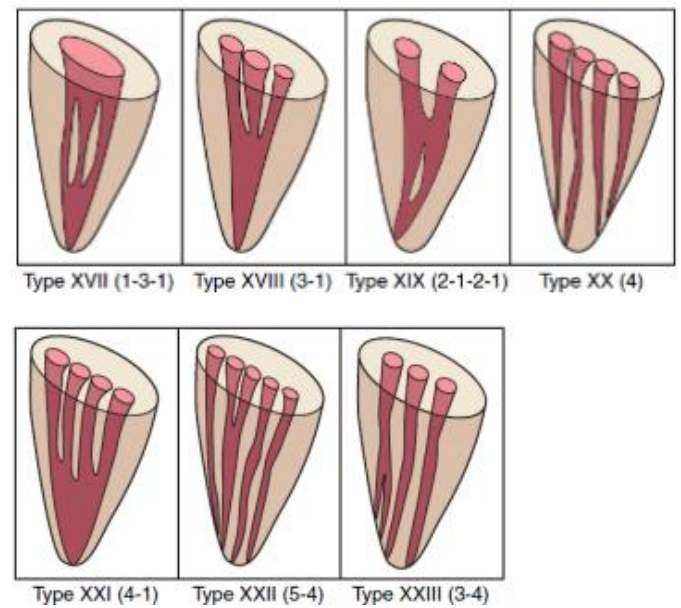
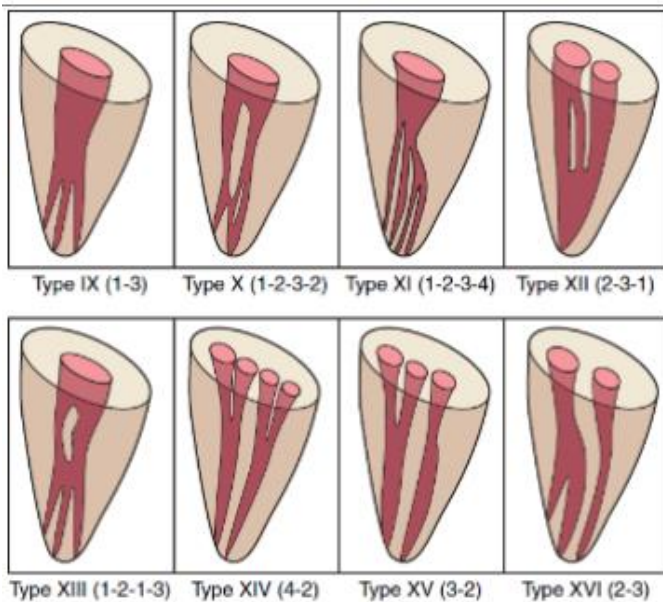


Figure 2: Sert and Bayirli's Additional Canal Types to Vertucci's Classification of Root Canal Systems (Type IX–Type XXIII).

to identify the complex variations in their root canal morphology. The ovoid shaped root in cross section normally has developmental grooves or depressions on the mesial and distal surfaces [4]. Root canal anatomy of mandibular second premolar can be highly complex.

In 1969, Weine et al. [14] provided the first clinical classification of more than one canal system in a single root and used the Mesiobuccal root of the maxillary first molar as the type specimen. Pineda and Kuttler [15] and Vertucci [16] further developed a system for canal anatomy classification for any tooth having a broad buccolingual diameter and more applicable for use in laboratory studies (Figure 1). But additional canal types which were not included in Vertucci's original classification system have been reported by Sert and Bayirli [17] (Figure 2) and Gulabivala et al. [18] Sert and Bayirli reported an additional 15 new canal types that have not yet been classified [17].

The purpose of this paper is to describe endodontic treatment of mandibular second premolar with three separate root canals and with unusual root morphology.

### Case report 1

A 40 years old male patient reported to our Out Patient Department of Conservative Dentistry and Endodontics with pain in his lower jaw in the left back tooth region.

Clinical and radiographic examination revealed a deep carious lesion in lower left second premolar (Figure 3) with unusual root morphology (Figure 4). Electric pulp testing caused severe lingering pain. A diagnosis of symptomatic irreversible pulpitis was made and it was decided to carry out endodontic treatment in the lower left second premolar.



Figure 3: Pre-operative Radiograph of 35

Local anaesthesia was achieved by administration of inferior alveolar nerve block with 2% lidocaine; the premolar was



Figure 4: Pre-operative Radiograph of 35 showing outline of unusual root morphology isolated under rubber dam (Hygenic Coltene Whale dent). Following excavation



Figure 5: Clinical picture showing three orifices (two buccal and one lingual) of 35 of caries with a round bur (Mani Diamond Bur - BR-41) conventional access cavity was prepared using a non-end cutting bur (Endo-Z Bur, Dentsply Maillefer). Clinical examination with a DG 16 explorer (HuFriedy, USA) revealed three orifices: two buccal and one lingual (Figure 5). Preendodontic build-up was done using



Figure 6: Working length Radiograph showing three separate canals

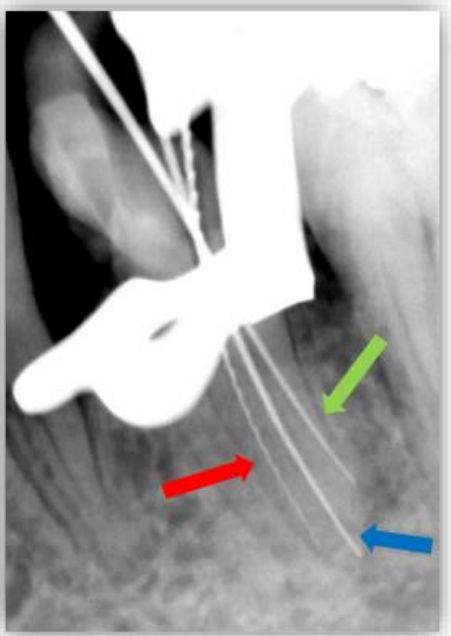


Figure 7: Radiograph showing #20 Spreader (green), #15H file (red) and #20K file (blue) in distobuccal canal, mesio-buccal canal and lingual canal respectively composite (Te-Econom Plus Composite, Ivoclar). Working length radiograph revealed three separate canals (Figure 6).

Apical preparation was done up to size 20 using stainless steel hand files (Mani K files) using EDTA (Neo EDTA



Figure 8: Radiograph showing master cone verification Gel, Orikam). A size 20 spreader, size 15 H file and size 20 K file was put in the distobuccal canal, mesio-buccal canal and lingual canal respectively to clearly differentiate the three separate canals as well as roots (Figure 7). Biomechanical preparation up to apical size 25 was carried out using NiTi Rotary instruments (Neo Endo Flex, Orikam) with a taper of 4% using a torque-controlled endo motor (Canal Pro 2, Coltene Whale dent). The canals were irrigated with copious amount of 5% sodium hypochlorite (Par can, Septodont) solution and 17% EDTA solution (Neo EDTA solution, Orikam). Master cone was confirmed (Figure 8) and the canals were dried with paper points (Orikam).





Figure 9: Clinical picture showing obturation of 35  
Obturation was done in the order: lingual canal, followed by the disto-buccal and mesio-buccal canal (Figure 9) with gutta percha cones using single cone obturating technique, using calcium hydroxide-based sealer (Apex it Plus, Ivoclar). Post-obturation restoration was done using composite (Te-Econom Plus Composite, Ivoclar) (Figure 10). The patient was recalled after a week for followup and was found to be asymptomatic following which he was referred to the Department of Prosthodontics for extra coronal restoration.



Figure 10: Radiograph showing Post Obturation Restoration of 35

**Case report 2:** A 35 years old male patient reported to our Out Patient Department of Conservative Dentistry and Endodontics



Figure 11: Pre-Operative Radiograph showing 35

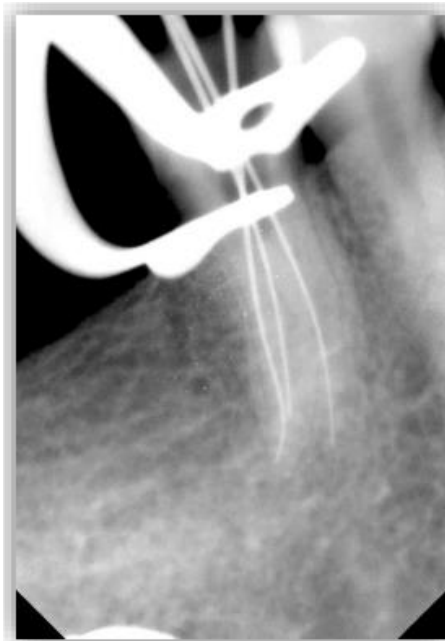


Figure 12: Working length radiograph showing three root canals of 35 with pain in his lower jaw in the left back tooth region. Clinical evaluation revealed mesio proximally carious

mandibular left second premolar. Radiographic examination (Figure 11) revealed pulpal exposure which



Figure 13: Radiograph showing master cone selection of 35

necessitated root canal treatment of the tooth. Under the influence of local anaesthesia (2% lidocaine) and rubber dam isolation (Hygienic, Coltene Whale dent) conventional access cavity was prepared using round bur (Mani, Japan) and non-end cutting bur (Endo-Z, Dentsply). Clinical examination with a DG 16 explorer (HuFriedy, USA) revealed three orifices, two buccal and one lingual. Working length radiograph revealed three separate canals (Figure 12).

Apical preparation was done up to size 20 using stainless steel hand files (Mani K files) using EDTA (Neo EDTA Gel, Orikam). Biomechanical preparation up to apical size 25 was carried out using NiTi Rotary instruments (Neo Endo Flex, Orikam) with a taper of 4% using a torque-controlled endo motor (Canal Pro 2, Coltene Whale dent). The canals were irrigated with copious amount of 5% sodium hypochlorite (Par can, Septodont) solution and 17% EDTA solution (Neo EDTA solution,

Orikam). Master cone was confirmed (Figure 13) and the canals were dried with paper points (Orikam).



Figure 14: Radiograph showing obturation of 35

Obturation was done (Figure 14) with gutta percha cones using single cone obturating technique using calcium hydroxide-based sealer (Apex it Plus, Ivoclar). Post-obturation restoration was done using composite (Te-Econom Plus Composite, Ivoclar) (Figure 14). The patient was recalled after a week for followup and was found to be asymptomatic following which he was referred to the Department of Prosthodontics for extracoronary restoration.

### Discussion

Studies have reported that the incidence of two or more canals in mandibular second premolar may vary between 1.2% and 3.4% [5-7]. According to Sert and Bayirli an incidence of 0.4% of mandibular second premolars with three root canals have been reported [8]. Vertucci assessed the root canal morphology in 100 Turkish male and 100 Turkish female patients [9]. Men (43%) exhibited two or more canals much more frequently than the female patients (15%) in the study. Vertucci reported an incidence of 2.5% of two separate and distinct root canals in mandibular second premolars; however he has

not reported any case of mandibular second premolar with three root canals<sup>[10]</sup>.

Mandibular second premolars mostly have a single root. The incidence of 2 or more roots is low, approximately 0.4%, whereas in mandibular first premolar it is 2.1% [11]. Majority of the mandibular premolars have a single canal, but approximately 9% have 2 or more canals. A single apical foramen might be found in mandibular teeth in more than 9 out of ten cases, but 2 or more foramina may occur approximately 8.2% of the time [11]. The incidence of more than 1 root, more than 1 canal, and more than 1 foramen is less frequent in the mandibular second premolar than in the mandibular first premolar<sup>[11]</sup>.

Thirty-six anatomic studies were analyzed by Kottoor et al.<sup>[13]</sup>, which included 12,752 first premolars and nineteen studies assessing 6646 second premolars. A significant variation in the number of roots, root canals, and apical foramina was observed between Caucasian, Indian, Mongoloid, and Middle Eastern ethnicities. The most common anatomic variation was C-shaped canals in mandibular first premolars with highest incidence in Mongoloid populations (up to 24%).

According to a study by Singh and Pawar<sup>[19]</sup> the prevalence of type IX root canal morphology is only 2% for mandibular first premolars in Indian population, however the prevalence of type IX root canal morphology in mandibular second premolar has not been reported thus far. Zillich et al. and Vertucci et al. reported in their studies the incidence of second premolars to be at 0.4% and 0%, respectively<sup>[7,20]</sup>.

The variability in root canal morphology is an usual phenomenon. Radiographs taken at different horizontal angulations facilitate searching for additional roots and canals. If a radiolucent line is present mesial or distal to the main canal, an additional canal should be suspected.

Magnification and fibre optic illumination are helpful in increasing the optical field. Tactile examination of the walls of the major canal with a small precurved file tip is mandatory, even in cases which appear to have only one canal radiographically.

A frequent issue which may be encountered during endodontically treating type VIII root canal is visibility and accessibility during obturation as there is limited space in the middle third of the tooth. For this reason, we chose to obturate the lingual canal first as it was easily accessible compared to the buccal canals. After coating the gutta percha cone with sealer it was fitted into the lingual canal after which a small sized heat carrier plugger (Dentsply) was used to sear off the gutta percha cone at the level of orifice. This allowed adequate space for the the other two gutta percha cones to be fitted one after the other with little hindrance and adequate visibility thereafter.

Albuquerque et al. reviewed the management of variable anatomy in mandibular premolars. They emphasized the importance of understanding of normal anatomy and common variations, careful interpretation of angled radiographs, use of three-dimensional imaging, proper access cavity preparation, and a detailed exploration of the interior of the tooth, ideally under magnification<sup>[21]</sup>.

Slowey felt that mandibular premolars were the most difficult teeth to treat endodontically because of their aberrant anatomy [14]. Hence a complete awareness of their statistical data is important for the clinician to achieve a higher degree of success in endodontic treatment.

Appropriate diagnosis is must before starting root canal procedure in these teeth to ensure successful treatment outcome. Failure to identify supernumerary roots can affect the prognosis of endodontic treatment. An accurate diagnosis and thorough knowledge and about

the variation in root canal morphology, prevalence and canal configuration of mandibular second premolars is prerequisite for long term endodontic success.

### **Conclusion**

Clinician should be aware of variations related to canal configuration and types in mandibular premolars. Tactile examination is a key step in locating the extra/split canal. The presence of extra canals should be thought of in every tooth undergoing endodontic treatment. This would help in reducing endodontic failure due to incomplete obturation.

**Acknowledgement:** I am highly grateful to, Dr Sourav Bhattacharyya (Associate Professor Dept. of conservative dentistry & endodontics, Haldia Institute of Dental Sciences & Research,), Dr Debanjan Das, Dr Trishagni Choudhury, and Dr Abhishek Guria (Assistant professor, Dept. of conservative dentistry & endodontics, Haldia Institute of Dental Sciences & Research), for their immense help, encouragement and guidance throughout my work.

### **References**

1. F. Vertucci, J. Haddix, and L. Brito, *Tooth Morphology and Access Cavity Preparation*, Mosby, St Louis, Mo, USA, 9th edition, 2006.
2. J. F. Siqueira Jr. and I. N. Roca, "Clinical implications and microbiology of bacterial persistence after treatment procedures," *Journal of Endodontics*, vol. 34, no. 11, pp. 1291–1301, 2008.
3. J. Ingle and L. Bakland, *Endodontics*, BC Decker, Hamilton, New Zealand, 5th edition, 2002
4. Weine FS, Healey HJ, Gerstein H, Evenson L. Canal configuration in the Mesio Buccal root of the maxillary first molar and its endodontic significance. *Oral Surg Oral Med Oral Pathol* 1969; 28:419–425
5. M. T. Barrett, "The internal anatomy of teeth with special reference to the pulp and its branches," *Dental Cosmos*, vol. 67, pp. 581–592, 1925
6. F. Pineda and Y. Kuttler, "Mesiodistal and buccolingual roentgenographic investigation of 7,275 root canals," *Oral Surgery, Oral Medicine, Oral Pathology*, vol. 33, no. 1, pp. 101–110, 1972.
7. R. Zillich and J. Dowson, "Root canal morphology of mandibular first and second premolars," *Oral Surgery Oral Medicine and Oral Pathology*, vol. 36, no. 5, pp. 738–744, 1973.
8. S. Sert, G. S. Bayirli, "Evaluation of the root canal configurations of the mandibular and maxillary permanent teeth by gender in the Turkish population," *Journal of Endodontics*, vol. 30, no. 6, pp. 391-398, 2004.
9. F. J. Vertucci, "Root canal anatomy of the human permanent teeth," *Oral Surgery Oral Medicine and Oral Pathology*, vol. 58, no. 5, pp. 589-599, 1984
10. F. J. Vertucci, "Root canal morphology of mandibular premolars," *The Journal of the American Dental Association*, vol. 97, no. 1, pp. 47-50, 1978.
11. B.M. Cleghorn, W. H. Christie, and C. C. S. Dong, "The root and root canal morphology of the human mandibular first premolar: a literature review," *Journal of Endodontics*, vol. 33, no. 5, pp. 509–516, 2007.
12. D. Albuquerque, J. Kottoor, and M. Hammo, "Endodontic and clinical considerations in the management of variable anatomy in mandibular premolars: a literature review," *BioMed Research International*, vol. 2014, Article ID 512574, 11 pages, 2014.
13. J. Kottoor, D. Albuquerque, N. Velmurugan, and J. Kuruvilla, "Root anatomy and root canal configuration of human permanent mandibular premolars: a systematic



review,” *Anatomy Research International*, vol. 2013, Article ID 254250, 14 pages, 2013.

14. R. R. Slowey, “Root canal anatomy—road map to successful endodontics,” *Dental Clinics of North America*, vol. 23, no. 4, pp. 555–573, 1979.

15. Pineda F, Kuttler Y. Mesiodistal and buccolingual roentgenographic investigation of 7,275 root canals. *Oral Surg Oral Med Oral Pathol* 1972; 33:101–110

16. Vertucci FJ. Root canal anatomy of the human permanent teeth. *Oral Surg Oral Med Oral Pathol* 1984; 58:589–599

17. Sert S, Bayirli GS. Evaluation of the root canal configurations of the mandibular and maxillary permanent teeth by gender in the Turkish population. *J Endod* 2004; 30:391–398.

18. Gulabivala K, Opasanon A, Ng YL, Alavi A. Root and canal morphology of Thai mandibular molars. *Int Endod J* 2002; 35:56–62.

19. Singh S, Pawar M. Root canal morphology of South Asian Indian mandibular premolar teeth. *J Endod* 2014; 40:1338-41.

20. Vertucci FJ. Root canal morphology of mandibular premolars. *J Am Dent Assoc* 1978; 97:47–50.

21. Lee, Seok-Ryun & Shin, Seol-Hee & Hong, Sung & Song, Chang-Kyu & Chang, Hoon-Sang & Min, Kyung-San. (2010). Root canal treatment of a mandibular second premolar with three separate root canals. *Restorative Dentistry and Endodontics*. 35