



Endodontic Treatment of Mandibular Premolars with Vertucci Type V Configuration: A Case Series

¹Dr. Anirban Bhattacharyya, Professor and Head of Department, Dept. of Conservative Dentistry & Endodontics, Haldia Institute of Dental Sciences & Research, Banbishnupur, Balughata, Haldia, West Bengal, India

²Dr. Asim Bikash Maity, Professor, Dept. of Conservative Dentistry & Endodontics, Haldia Institute of Dental Sciences & Research, Banbishnupur, Balughata, Haldia, West Bengal, India

³Dr. Sourav Bhattacharya, Associate Professor, Dept. of Conservative Dentistry & Endodontics, Haldia Institute of Dental Sciences & Research, Banbishnupur, Balughata, Haldia, West Bengal, India

⁴Dr. Gayatri Majumdar, Associate Professor, Dept. of Conservative Dentistry & Endodontics, Haldia Institute of Dental Sciences & Research, Banbishnupur, Balughata, Haldia, West Bengal, India

⁵Dr. Trishagni Chaudhury, Associate Professor, Dept. of Conservative Dentistry & Endodontics, Haldia Institute of Dental Sciences & Research, Banbishnupur, Balughata, Haldia, West Bengal, India

⁶Dr. Ahana Chakraborty, PG Scholar, Dept. of Conservative Dentistry & Endodontics, Haldia Institute of Dental Sciences & Research, Banbishnupur, Balughata, Haldia, West Bengal, India

⁷Dr. Sourav Kirtania, PG Scholar, Dept. of conservative dentistry & Endodontics, Haldia Institute of Dental Sciences & Research, Banbishnupur, Balughata, Haldia, West Bengal, India

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Corresponding Author: Dr. Ahana Chakraborty, PG Scholar, Dept. of Conservative Dentistry & Endodontics, Haldia Institute of Dental Sciences & Research, Banbishnupur, Balughata, Haldia, West Bengal, India

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Abstract

One of the main reasons of failure in microorganisms in missed or extra canals. Mandibular endodontically treated teeth is the presence of first and second premolars usually have a single root

with a single root canal. The presence of two separate root canals in the apical third of the root is quite rare. Careful clinical examination of the pulp chamber is helpful in locating canal orifices and radiographic interpretation is useful for the diagnosis of the additional canals. The mandibular premolars with Vertucci type V canal configuration pose a challenge in clinical management. This case series describes the diagnosis and endodontic management of mandibular premolars with Vertucci's Type V root canal configuration.

Keywords

Anatomical variations, mandibular first

premolar, mandibular second premolar, Vertucci type V, root canal therapy.

Introduction

Success in root canal treatment lies in a thorough knowledge of root canal systems and their three-dimensional cleaning and shaping followed by hermetic sealing of the cleaned and shaped canals[1]. Diversity of root canal anatomy in permanent dentition is very common.

Weine *et al.*(1969)[2] provided the first clinical classification of more than one canal system in a single root and used mesiobuccal root of maxillary first molar as the type specimen (Fig. 1)

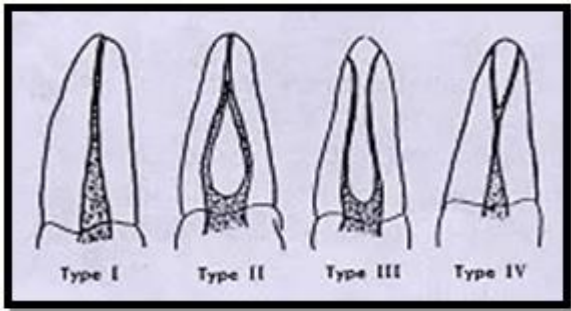


Fig. 1: Weine's Classification of Root Canal Systems (Types I–Type IV)

Pineda and Kuttler (1972) [3] and Vertucci (1984)[4] developed a system for classification of canal anatomy for any tooth with a broad buccolingual diameter (Fig. 2).

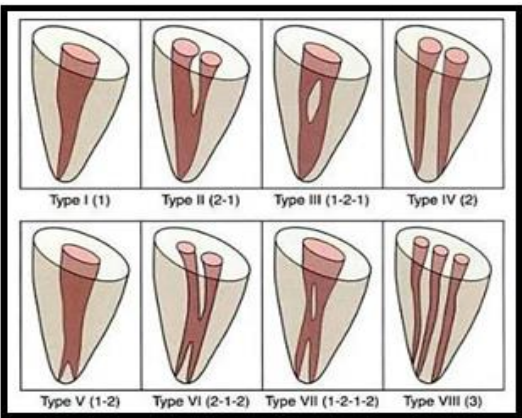


Fig. 2: Vertucci's Classification of Root Canal Systems (Types I–Type VIII)

Additional canal types were not included in Vertucci's original classification system.

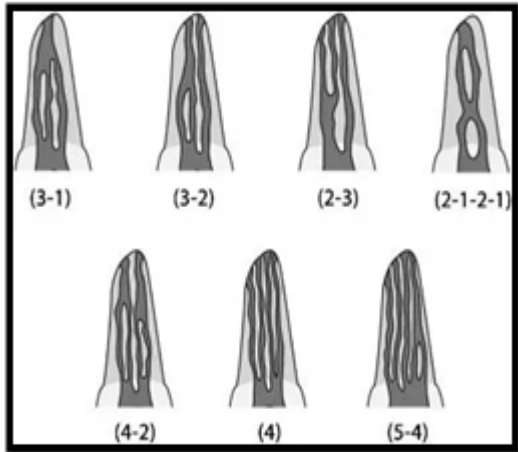


Fig. 3: Gulabivala's supplemental canal configurations

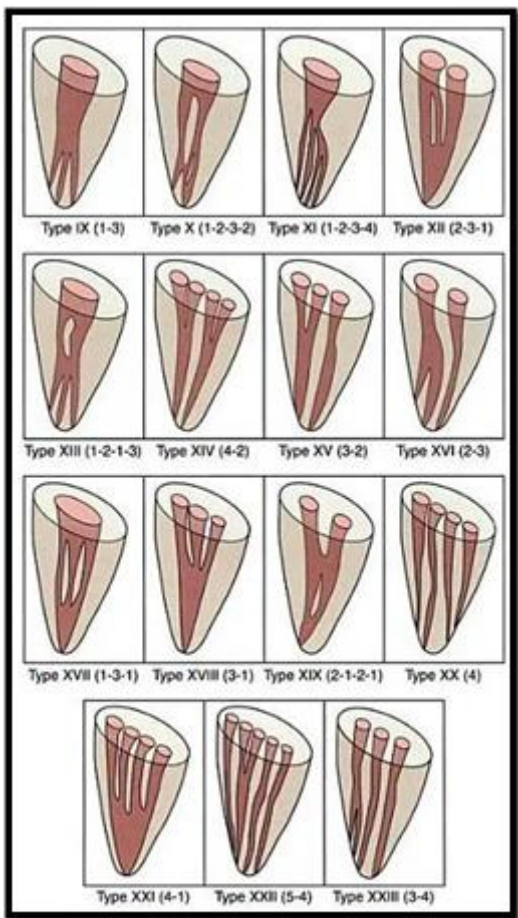


Fig. 4: Sert and Bayirli's additional canal types (Type IX–Type XXIII)

Additional new canal types were reported by Gulabivala *et al.* (2002)[5] (Fig. 3) and Sert and Bayirli (2004)[6] (Fig. 4).

The mandibular first premolars typically present with single root canal system in cases ranging from 69.3% to 86% and two canals ranging from 14% to 25.5%[3,7-9].

According to a study by Singh (2014), mandibular first premolars, in an Indian population, had a single root occurrence in 94% of teeth, 6% with two roots and 0% for three roots while mandibular second premolars had a single root in 92% teeth, two roots in 8% teeth and no samples had three roots. Type I anatomy was most prevalent (80% for mandibular first premolars and 66% for mandibular second premolars) while Type V canal configuration accounted only for 2% of all mandibular first premolars and 4% of all mandibular second premolar teeth studied[10].

The purpose of this case report is to describe

the endodontic treatment of single rooted mandibular first and second premolars with Vertucci Type V root canal configuration.

Case Report 1

A 31-year-old female patient with a non-contributory medical history reported to our Out Patient Department of Conservative Dentistry and Endodontics of Haldia Institute of Dental Sciences and Research complaining of pain on the lower right back teeth region since 2 weeks. He gave a history of sharp and intermittent pain in the same region for the past three months. Intraoral clinical and radiographic examination revealed deep occlusal secondary caries involving pulp in the right mandibular first premolar with unusual canal configuration (Fig. 5A & 5B).

The tooth had exaggerated response to electric pulp tester and the diagnosis of chronic irreversible pulpitis was made. Routine non-surgical endodontic treatment was planned.



Fig. 5A: Pre-operative radiograph of #44

After obtaining the informed consent for the root canal treatment, the tooth was isolated with a

rubber dam (Hygenic, Coltene Whaledent, Switzerland) following infiltration with local anesthesia (2%

lidocaine with 1:100000 epinephrine). A conventional endodontic access was prepared with an Endo Access Bur (Dentsply, Maillefer, Switzerland) and an Endo Z

bur (Dentsply, Maillefer, Switzerland). Canal orifices were identified with a DG 16 explorer (Hu-Friedy, USA) and the access cavity was modified accordingly.

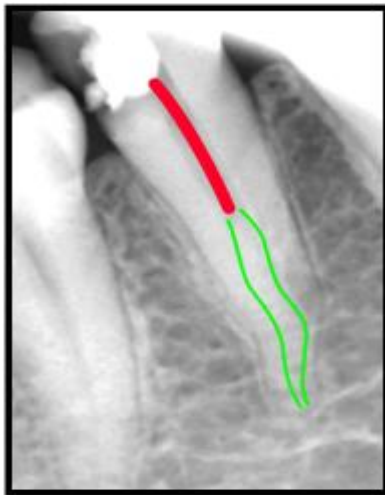


Fig. 5B: Pre-operative radiograph of #44 showing unusual canal configuration

After checking the patency of the two canals, with #10K file (Dentsply-Maillefer), the working lengths of the canals were determined; B = 18 mm and L = 18 mm using an apex locator (Canal Pro Coltene, Whaledent, Switzerland). Working length radiographs

were taken to confirm the two separate root canals diverging from the middle third (Fig. 6)

A size 15 spreader and size 15 H file were put in the buccal and lingual canals respectively to clearly differentiate between the two separate canals. (Fig. 7)



Fig. 6: Working length radiograph showing two separate root canals

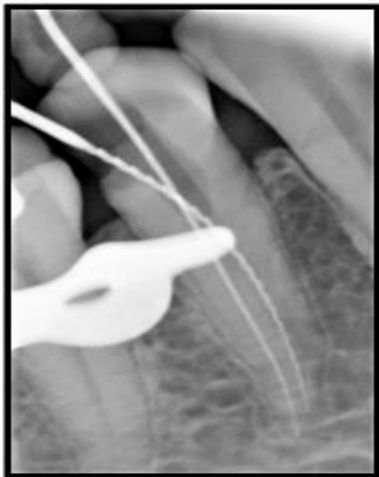


Fig. 7: Radiograph showing #15 spreader and #15H file to distinguish between buccal canal and lingual

NiTi Rotary instruments (Neo Endo Flex, Orikam) with a taper of 4% were used to prepare both the canals using a torque controlled endomotor (Canal Pro 2, Coltene Whaledent, Switzerland).

Copious amount of 5% sodium hypochlorite

solution (Parcan, Septodont) was used for irrigation during instrumentation and a final rinse was done using 17% EDTA (RC Help, Prime Dental) for 1 minute. Master cone was confirmed (Figure 8) and the canals were dried with paper points (Orikam).



Fig. 8: Radiograph showing master cone verification

Obturation was done using calcium hydroxide based sealer (Apexit Plus, Ivoclar). The postoperative

radiograph showed satisfactory obturation. Post endodontic restoration was done with composite (Te-

EconomPlus Composite, Ivoclar) (Fig. 9). The patient was recalled after a week for follow-up and was found to be asymptomatic following which he was referred to

the Department of Prosthodontics and Crown and Bridge for extracoronal restoration.



Fig. 9: Post-operative radiograph of #44

Case Report 2

A 55-year-old male patient with medical history of asthma for over 5 years reported to our Out Patient Department of Conservative Dentistry and Endodontics of Haldia Institute of Dental Sciences and Research complaining of dull and lingering pain on the lower left back teeth region since 2 months. The pain was increasing on consumption of any food and biting.

Intraoral clinical and radiographic examination revealed an endodontically treated left mandibular second premolar with a missed canal left unobturated and unusual root morphology (Fig. 10).

The tooth had exaggerated response to percussion test and the diagnosis of symptomatic apical periodontitis was made. Non-surgical endodontic retreatment was planned.



Fig. 10: Pre-operative radiograph of #35

After obtaining the informed consent for endodontic retreatment, the tooth was infiltrated with local anesthesia (2% lidocaine with 1:100000 epinephrine). Because of the contributory medical history, rubber dam could not be applied. However isolation was achieved with cotton rolls and high volume evacuators. The post endodontic restoration was removed using a round bur (Mani Diamond Bur BR-31). Canal orifices were identified with a DG 16 explorer (Hu-Friedy, USA) and the access cavity was modified accordingly. Guttapercha was removed using Hyflex remover (Coltene Whaledent, Switzerland) and the additional canal was scouted and patency check was done for both the canals, with #10K file (Dentsply-Maillefer). After working length determination; B = L = 17 mm using an apex locator (CanalPro Coltene, Whaledent, Switzerland), biomechanical preparation was performed using Hyflex EDM rotary NiTi files and a torque controlled endomotor (Canal Pro 2, Coltene, Whaledent, Switzerland) with tactile-controlled activation technique and copious amount of 5% sodium hypochlorite solution (Parcan, Septodont) as an irrigant.

A closed dressing of calcium hydroxide (RC Cal, Prime Dental) was given and patient was recalled

after 21 days for obturation. In the follow-up appointment, tooth was completely asymptomatic. The canals were instrumented again and irrigated with 5% sodium hypochlorite solution (Parcan, Septodont) and finally the rinse was completed with 17% EDTA (RC Help, Prime Dental) for 1 minute to remove the intracanal calcium hydroxide properly. Obturation was done using gutta flow 2 sealer (Coltene, Whaledent, Switzerland) and Hyflex EDM One file GP. The GP was introduced into one of the canal still working length and sheared off at the point of bifurcation of the two root canals and compacted using a heated pre-fit plugger (Fig. 11). The same was repeated in the other canal and both the guttaperchas were downpacked. Upon completion of the downpack, backfill was accomplished coronally up using Calamus Dual (Dentsply, Maillefer). The postoperative radiograph showed satisfactory obturation. Post endodontic restoration was done with dual curing core & resin cement (Paracore kit, Coltene, Whaledent, Switzerland) (Fig. 12). Patient was recalled after a week for follow-up and was found to be asymptomatic following which he was referred to the Department of Prosthodontics and Crown and Bridge for extra coronal restoration.



Fig. 11: Obturation procedure with GP in one of the canals sheared off at the point of



Fig. 12: Post-operative radiograph of #35

Case Report 3

A 18-year-old male patient with a non-contributory medical history reported to our Out Patient Department of Conservative Dentistry and Endodontics of Haldia Institute of Dental Sciences and Research complaining of dull and lingering pain on the lower right back teeth region since 1 month. The pain was increasing on consumption of any food and biting.

Intraoral clinical and radiographic examination revealed a deep occlusal caries involving pulp in the right mandibular first premolar with periapical radiolucency (Fig. 13). The tooth had exaggerated response to percussion test and the diagnosis of symptomatic apical periodontitis was made. Routine non-surgical endodontic treatment was planned.



Fig. 13: Pre-operative radiograph of #44

After obtaining the informed consent for the root canal treatment, the tooth was isolated with a rubber dam (Hygenic, ColteneWhaledent, Switzerland) following infiltration with local anesthesia (2% lidocaine with 1:100000 epinephrine). After conventional endodontic access cavity preparation with Endo Access Bur (Dentsply, Maillefer, Switzerland) and an Endo Z bur (Dentsply, Maillefer, Switzerland),

canal orifices were identified with a DG 16 explorer (Hu-Friedy, USA). After checking the patency of the two canals, with #10K file (Dentsply-Maillefer), the working lengths of the canals were determined; B = 16 mm and L = 17.5 mm using an apex locator (CanalProColtene, Whaledent, Switzerland) and a radiograph was taken to confirm the two separate root canals diverging from the middle third (Fig. 14).

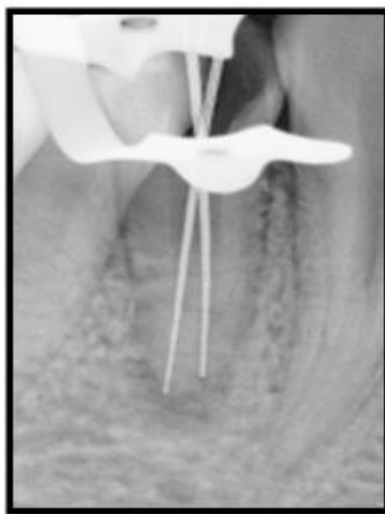


Fig. 14: Working length radiograph showing two separate canals

Biomechanical preparation was completed using ProTaperGold (Dentsply, Maillefer, Switzerland) rotary NiTi files (till F2) using a torque controlled endomotor (Canal Pro 2, ColteneWhaledent, Switzerland) with copious amount of 5% sodium hypochlorite solution (Parcan, Septodont) as the irrigant. A closed calcium hydroxide dressing (RC Cal, Prime Dental) was given and the patient was recalled after 14 days for obturation.

In the follow-up appointment, tooth was completely asymptomatic. The canals were instrumented again and irrigated with 5% sodium

hypochlorite solution (Parcan, Septodont) and a final rinse with 17% EDTA (RC Help, Prime Dental) for 1 minute to remove the intracanal calcium hydroxide properly and to remove the smear layer respectively. The canals were dried using paper points (Orikam) and the master cone radiograph was taken (Fig. 15). Obturation was completed using calcium hydroxide based sealer (Apexit Plus, Ivoclar). The postoperative radiograph showed satisfactory obturation.

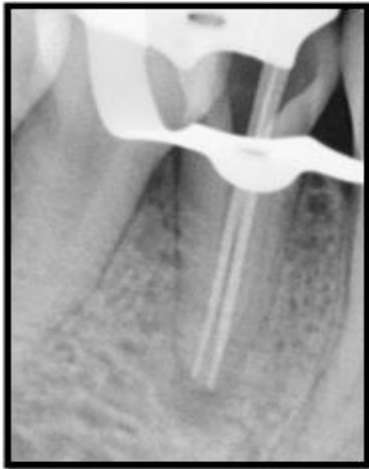


Fig. 15: Radiograph showing master cone verification

Post endodontic restoration was done with composite (Te-EconomPlus Composite, Ivoclar) (Fig. 16). Patient was recalled after a week for follow-up and

was found to be asymptomatic following which he was referred to the Department of Prosthodontics and Crown and Bridge for extracoronary restoration.



Fig. 16: Post-operative radiograph of #44

Discussion

Success of endodontic therapy relies on the identification of the anatomy and morphology of entire root canal system. A thorough knowledge of the same is extremely necessary to increase efficiency and

consequently, the rate of clinical success of the endodontic treatment[11].

The most common type of root canal morphology of mandibular first and second premolars is

the presence of a single root with a single canal at the apex [9]. Vertucci (1984) in his study reported 70% mandibular first premolars having only one canal at the apex with Type I canal configuration while 24% samples having Type V canal configuration. In mandibular second premolars, he reported 97.5% having one canal at apex with Type I canal configuration and 2.5% samples having Type V canal configuration among four hundred extracted teeth samples of mandibular first and second premolars each [4].

Troupe (1986) found significant ethnic differences for canal morphology and configurations between African American and Caucasian patients [12]. Study about canal configurations on mandibular and maxillary premolars on a Turkish population by Sert and Bayirli (2004) further reinforced the importance of ethnic differences as well as possible gender differences [6].

In an in vitro study by Velmurugan *et al.* (2009), out of one hundred extracted human mandibular first premolars from an Indian population, 72% samples were reported to have Vertucci's Type I root canal configuration as the most prevalent group while Type V was only 8% [13]. Shetty *et al.* (2014), in an in vitro study on one thousand one hundred and eighty six and eight hundred and fourteen human mandibular first and second premolars respectively extracted from a South Indian population, reported that the most common configuration in mandibular first and second premolars was Vertucci's Type I (83.81% and 93.48% respectively) followed by Type V (11.97% and 3.5% respectively) [14].

Slowey (1979) suggested that the mandibular premolars may present with the greatest difficulty of all teeth to treat endodontically [15]. A University of Washington study assessed the failure rate of non-

surgical root canal treatment in all teeth. It was highest for the mandibular first premolar at 11.45% [16]. Possible reasons for a high failure rate are the numerous variations in root canal morphology and difficult access, cleaning and sealing of a second canal. There is usual straight-line access to the buccal canal while lingual canal branches below the chamber at a sharp angle, potentially resulting in a missed canal [17].

The pulp chamber floor helps in identification of supplementary root canal aberrations [18]. Radiographs help determine the shape, position and relative root outline. Various studies concluded that broad, flat roots are more likely to have multiple canals and intracanal ramifications where multiple angled radiographs are mostly useful in revealing the true dimensions of the root canal [19].

Martinez-Lozano *et al.* recommend upto 40° mesial angulation from horizontal plane for identifying additional canals. In mandibular first premolar, deviation of the x-ray angle from 15° to 30° in vertical axis was effective in visualizing proper root canal anatomy. Yoshioka *et al.* reported that sudden narrowing of the main canal on the parallel radiograph was a good criterion for detection of additional root canals [20].

Magnification aids like loupes and dental operating microscopes allows better visualization of the root canal anatomy. Advanced diagnostic imaging modalities like cone-beam computed tomography (CBCT) also provides a three-dimensional image [21]. However, CBCT was not available at our institution and the use of 2D radiographic images seemed sufficient to make accurate diagnosis for this case.

Conclusion

It is of utmost importance that the clinicians be aware of the morphological variations and

complications in canal configuration. Hence one should consider a thorough reading of angled radiographs and utilisation of the various diagnostic modalities like CBCT and properly inspect the pulp floor and interior of the tooth, ideally under magnification for treating mandibular premolars because of their complexity in root and canal morphology.

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