

Case Report

Endodontic Management of Mandibular Second Premolar Having Type-V Vertucci Canal Configuration – Case Series

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Abstract: Successful endodontic treatment depends on thorough knowledge in root canal morphology, appropriate assessment of pulp chamber floor, critical interpretation of radiograph, and on biomechanical preparation followed by three dimensional obturation of root canal system. The possibility of additional root /canal should be considered even in teeth a low frequency of abnormal root canal anatomy. Mandibular premolars have earned the reputation for having aberrant anatomy. This article reports and discusses the successful endodontic management of mandibular second premolar with one canal is bifurcating into two canals.

Keywords: Mandibular second premolar, abnormal morphology, Vertucci type-V, Root canal therapy.

INTRODUCTION

A thorough understanding of root canal anatomy, morphology and use of various diagnostic imaging techniques, magnification helps to locate all the canals, clean, shape and obturate the canal space in three dimensionally. Thereby helps to achieve high levels of success in endodontic treatment [1-3].

One of the major reasons for failure of root canal treatment is missed canals. Mandibular premolars have earned the reputation for having aberrant anatomy. The incidence of a mandibular second premolar having additional canals is rare [4]. Studies reported by Green [17], Hess [16], Kerekes & Tronstad [18], Mueller [19], Pineda & Kuttler [20], and Vertucci [21], dealing with the number and form of roots and root canals of mandibular premolars have revealed that in most instances they have only one root canal, although teeth with two or more root canals do exist. In the literature approximately 98% of the mandibular second premolar teeth are single rooted. The incidence of two roots was 1.8%. Three roots were found in less than 0.2% of the teeth studied. Four roots were rare and found in less than 0.1% of the teeth studied.

Vertucci in his series of studies conducted on extracted teeth, reported 2.5% incidence of a second

canal. Zilich and Dawson reported 11.7% occurrence of two canals and 0.4% of three canals. According to Ingle, mandibular second premolars have only 12% chance of a second canal, 0.4% of a third canal and Harty has reported 11% possibility of second canal [5-8]. In most instances they have had one canal, but teeth with two or more canals have also been reported.

This case series attempts at explaining successful endodontic management of mandibular second premolar with unusual root, root canal morphology.

CASE REPORT-1

A 64 year old male patient reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of dull pain in lower right back region of jaw. The medical history was non-contributory. On Clinical Examination Class II composite restoration was seen in tooth no. 45. The tooth was sensitive to percussion and purulent discharge was seen interdentally with 45, 46. Tooth 45 didn't show any response to heat, cold and electric pulp testing.

Intra oral periapical radiograph of 44, 45 showed disto occlusal radio opacity with respect to 45

suggestive of composite restoration. 45 had single root with diffuse periapical radiolucency with measuring 5×3mm with loss of continuity in laminadura. Single root canal was seen which disappeared suddenly at middle to apical third level. The root tip was wider than usual. Both these features led to the suspicion of bifurcation of root canal. (Fig-1)



Fig-1: Pre operative radiograph of mandibular right first premolar showing sudden disappearing of canal at middle third, wider root tip than usual.

The clinical, radio graphical, pulp tests led to the diagnose of chronic periapical abscess and the necessity for the root canal treatment with respect to 45. Tooth was anesthetized by inferior alveolar nerve block using a 2% solution of Lignocaine hydrochloride containing 1:80000 adrenalines. Subsequently endodontic access was prepared with access opening bur in a high speed airtor hand piece. To gain sufficient access to the canal, the access opening was modified by extending more buccolingually than conventional access cavity, keeping in mind the straight line access to the possible bifurcation of the canals. Orifice location was not easy as the pulp chamber was unusually long. After careful inspection, exploration was done with DG16 explorer. Canal was explored with a # 10 k file which followed different directions on repeated introduction, hinting towards bifurcation of the canal. Two # 10 k file were inserted in the canal in different directions and working length radiograph was taken. Working length radiograph confirmed bifurcation of the canal at middle third level. The bifurcated root tip was also limited to 2-3mm from the apex. Working length also confirmed with apex locator (Root - ZX). (Fig-2)



Fig-2: working length radiograph of mandibular right second premolar showing single canal bifurcating in the middle one third. Two canals existed in separate apical foramina in respective roots

Coronal third of the root canal was enlarged using gate glidden drills up to size#3. The bifurcated canals were prepared using Protaper files (Dentsply Mailfilter) in crown down manner under copious irrigation with 5.25% sodium hypochlorite solution and 17% EDTA, both the canals were enlarged till F2 [25(0.08)].The canals were dried with sterile paper points, calcium hydroxide dressing was given and access cavity was closed with cavit. Patient was recalled after 2 weeks. At the second appointment as the tooth was asymptomatic. There was no purulent discharge interdentally with respect to 44 & 45. The canals were irrigated with saline to flush the Ca (OH)₂ dressing and dried with paper points.

The master cones, Protaper F2 gutta-percha were inserted to the full working length and apical tug back was checked for the bifurcated canals. Accessory cones were placed in the both the canals. The excess was sheared. The gutta-percha was condensed vertically with the hand pluggers.(Wave of compaction) (Fig-3&4)



Fig-3: master cone radiograph



Fig-4: vertical compaction

The remaining portion of the canal was wide, which could result in void in the obturation if lateral or vertical condensation techniques. Hence thermo plasticized gutta-percha obturation technique was using (E&Q Plus system). Access cavity was restored with cavit (3M).

Post treatment radiograph had taken to confirm the root canal system has been densely obturated. [Fig-5]

After one week coronal access was restored with composite restoration (3M ESPE), referred to the department of prosthodontics for the further treatment.

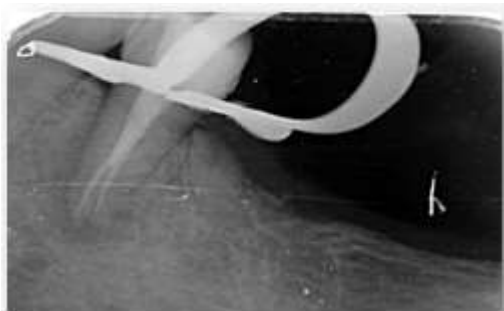


Fig-5: Post operative radiograph after final obturation

CASE REPORT-2

A 28 year old male patient reported to the department of conservative and endodontics with the chief complaint of pain in the lower right back teeth region for the past three days. Patient gave history of spontaneous and lingering pain on taking cold and hot foods since a week. On clinical examination deep caries was noted in 45. Vitality tests on the tooth 45, showed no response to cold, heat tests and EPT suggesting the tooth to be non vital.



Fig-6: Pre operative OPG showing mandibular right second premolar with single canal bifurcating at middle third and showing unusual root anatomy, also widening of PDL space seen

In OPG image tooth 45 showed wider root and coronal radiolucency approaching the pulp. The root canal bifurcation was seen at the middle third, there was also widening of apical periodontium.

The clinical, radiographical, pulp tests led to the diagnose of symptomatic apical periodontitis in 45 and root canal treatment was planned.

The patient was administered with 2% Lidocaine HCl in 1:80,000 Adrenalines, the tooth was isolated with rubber dam. Access opening was prepared using endo access bur, pulp chamber was explored

carefully with DG 16 explorer. Another root canal orifice was located lingual to the root canal orifice already found and working length was determined. It was found to be Type V root canal configuration according to Vertucci (Fig-7), cleaning and shaping was carried out by step down technique by Hyflex CM(coltene) [25(0.04)]. The root canals were irrigated using 2.5% sodium hypochlorite solution during root canal treatment. The canals were dried with sterile paper points, at the second appointment as the tooth was asymptomatic the canals were irrigated with saline and obturated with corresponding [25(0.04)] gutta-percha and resin sealer (AH Plus, Dentsply) (Fig-9, 10)

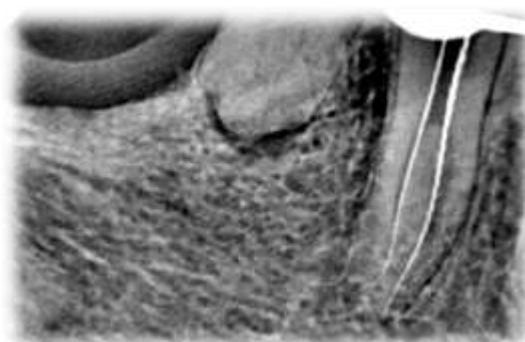


Fig-7: working length radiograph showing single canal bifurcating into two canals at middle third. Two canals existed in the separate apical foramina in the separate roots.

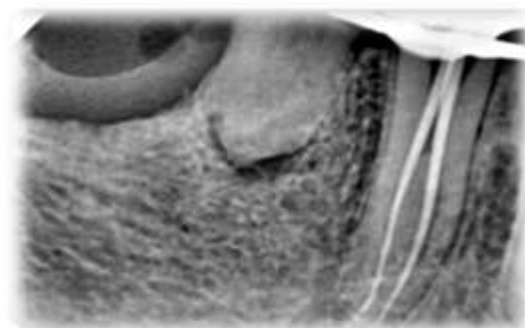


Fig-8: Master cone radiograph

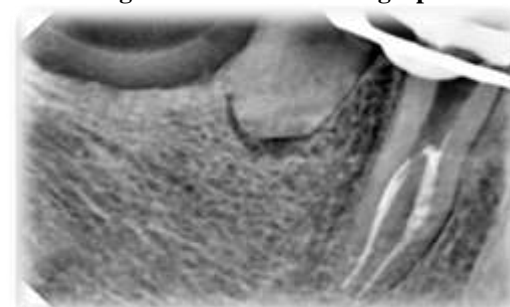


Fig-9: obturation done with gutta-percha and AH plus sealer (Dentsply)



Fig-10: Back fill by thermoplastic obturation

The backfill phase was done with thermoplastic obturation technique by E&Q plus system (heat softened gutta-percha injection) as the canal in the middle third and coronal third was wider which can result in voids. Post treatment radiograph was taken to confirm the root canal system has been densely obturated laterally vertically, to the canal terminus. The coronal access was restored with resin composite (3M ESPE) (Fig-10)

DISCUSSION

The diagnosis and management of extra root and root canals is undoubtedly an endodontic challenge. Endodontic treatment in second mandibular premolar with a varying morphology is a challenging task. Therefore, the internal morphology must be identified precisely to achieve successful treatment. Anatomical variations especially extra canals and roots should always be kept in mind when treating the teeth endodontically. Canals if left unexplored may harbor microorganisms, which have been reported to be a major cause of failure [9]. The mandibular second premolar with two root canals can usually be treated successfully using nonsurgical methods. The possibility of variations in root canal morphology must be considered before root canal treatment is undertaken. The wide ranges of variations are reported in literature regarding the number of roots and root canals in mandibular second premolar.

Scott and Turner describe the accessory root of mandibular premolar as Tome's root. The observed ethnic differences in root canal morphology and reported the highest incidence (>25%) of accessory roots of accessory roots in Australian and Sub Saharan African population. The lowest incidence (0-10%) of Tome's root occurred in the American, New Guinea, Jomon and Westren Eurasian population. Sert and Bayrili also reported sex differences in canal morphology, reporting higher incidence (44%) of accessory roots and canals in females as compared to males (34%) [10].

Table 1: Number of roots in the mandibular second premolar (incidence by number of teeth)

Reference (chronologic order)	1 root (%)	2 roots (%)	3 roots (%)
Sert and Bayirli (2004) ¹⁵	100	-	-
Zaatar et al (1997) ¹⁶	95.6	4.7	-
Caliskan et al (1995) ¹⁷	100	-	-
Geider et al (1989) ¹⁸	97.6	0.4	-
Vertucci (1978) ⁹	100	-	-
Zilich and Dowson (1973) ¹⁰	96.6	-	0.4
Barrett (1925) ¹⁹	100	-	-

Lu *et al.* are similar to Slowey suggestions that mandibular premolars are the most difficult to treat endodontically and also the apical configuration of these teeth was found to be complex [11].

Thus, a careful understanding and diagnosis of canal anatomy is of utmost importance for successful management of such cases. In these two cases, the root system was characterized by a single canal in coronal region bifurcating into two root canals (Vertucci type V). Several clinical techniques may be useful in the detection of a two canals in mandibular second premolars. In addition, if the pulp chamber appears to deviate from normal configuration and seems to be either oval or triangular in shape, more than one canal should be suspected [12]. Accurate preoperative radiographs of good quality, along with a proper view to the access opening, down into the chamber of a mandibular premolar tooth, long pulp chamber rarely shows any chamber floor, even when a suspected bifurcation of the canal is seen on the radiograph. At least two radiographs, with the second radiograph angulated from 15° to 20° either mesial or distal from the horizontal long axis of the root, are required to reliably diagnose more than one root or root canal system in premolar teeth [13]. A sudden narrowing of the main canal on a parallel radiograph was a good criterion to judge root canal multiplicity. However, Martinez-Lozano *et al.* recommend up to 40° mesial angulation from horizontal as more reliable in identifying the extra canals [14].

The surgical operating microscope also aids in canal visualization. Tactile examination of all the walls of the major canal with a small, precurved K-file tip is recommended, in order to probe for a catch which may indicate the orifice of an additional canal. Dyes, fiberoptic transillumination, magnifying loupes, and sodium hypochlorite bubbling in the extra canals help in locating additional canals [15].

Knowledge of basic root canal morphology of the mandibular second premolar, as well as its Variations, is essential in the treatment of this tooth. If all the canals had not been instrumented and obturated, a successful result would not have been achieved in this case.

Modification of the access cavity, enlarging the coronal third of canal up to the bifurcation sufficiently to gain access and ease in enlarging the bifurcated canal up to the working length.

Successful endodontic outcome in such cases is dependent upon careful use of all the available diagnostic aids to locate and treat the entire root canal system. Careful interpretation of angled radiographs, proper access preparation and detailed exploration of the tooth are essential prerequisites for a successful treatment outcome.

CONCLUSION

A good knowledge of root canal anatomy facilitates successful endodontic treatment. Management of teeth with morphological variations presents a challenge, which requires proper instruments and knowledge to use the instruments effectively. The present case reports emphasized the need to understand, interpret, and manage the mandibular second premolar with Vertucci type-V canal configuration which has been managed successfully.

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