

**Aberrant Root Canal Configuration of Mandibular Second Premolar – A Case Report and Literature Review**

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**Abstract**

The complexity of the root canal system with aberrant morphological variation of mandibular second premolar presents a constant challenge in the diagnosis and treatment of these teeth. A wider knowledge of anatomic variations is absolutely essential for endodontic success of such variant root canals. These teeth may require skills, magnification aids and specific root canal shaping and obturating techniques. Endodontic treatment may not be successful due to the failure to recognize and inability to treat multiple canals, however in mandibular second premolar various root canal variations are reported. Amongst the various documented reasons of root canal treatment failure most common is the inability to diagnose and treat accessory canals. Literature search shows no documented case of occurrence of two roots, and three

canals with three separate foramina in mandibular second premolars. This case report documents a rare root canal morphology in second mandibular premolar.

**Keywords:** Anatomical variation, Accessory Canals, Complex Anatomy, Cone-beam computed tomographic (CBCT), Mandibular Second Premolar, Root canal Configuration.

**Introduction**

Knowledge of both basic root and root canal morphology as well as possible variation in anatomy of the root canal system is important in achieving successful Endodontic treatment.[1] This is followed by endodontic triad for success that entails negotiation, shaping and cleaning of complete canal system in all dimensions, and obtaining a homogenous 3dimensional obturation. [2] Mandibular premolar is one such tooth which is often considered as

simple while in reality has a very aberrant root canal anatomy. In literature review of Cleghorn et al 2007, encompassed over 7700 mandibular premolar teeth and concluded that almost all second mandibular premolar teeth were single rooted and that multiple roots were extremely rare. A Single root with single canal was present in 91% of population [3]. Numerous invitro

studies have examined the root and root canal anatomy of different populations using different methods and reported intricate anatomical variations [3,4] however very few in vivo studies have been documented. Although some variations have been reported to be very rare, a knowledgeable clinician must be able to recognize them.

**Table 1: Case Reports on Variations in Canal Configuration of Mandibular Second Premolar.**

Year	Author	Population	Type of study	Diagnostic aid	Anatomical Variation
2008	Farmakis <sup>7</sup>	Greece	Clinical rct	Magnifying loupes and optical microscopy	Four roots and four canals
2009	Soares et al. <sup>8</sup>	Brazil	Clinical rct	Radiographic examination	Three canals
2009	Pai et al. <sup>9</sup>	Nepal	Clinical rct Retreatment	Radiographic examination	Two canals
2010	Aguiar et al. <sup>10</sup>		Clinical rct	Radiographic examination	Two separate roots And three root canals
2011	Borna et al. <sup>11</sup>	Iran	3 cases of clinical rct	Radiographic and clinical examination	Three canals
2012	Reddy et al. <sup>12</sup>	India	Clinical rct	Spiral computed tomography (sct).	Two roots and two canals
2014	Fathi et al. <sup>13</sup>	Iran	Clinical rct	Surgical microscope And cone-beam computed tomography (cbct)	Three roots and three Canals
2014	Chalil et al. <sup>14</sup>	India	Clinical rct	Radiographic and clinical examination	Two roots and two canals
2014	Hariharavel Et al. <sup>15</sup>	India	Clinical rct	Cone-beam computed tomography (cbct)	Three roots and three Canals
2014	Paul and dube <sup>16</sup>	India	Clinical rct	Radiographic and clinical examination	Three roots and three Canals

2015	Sinanoglu <i>et al.</i> <sup>17</sup>	Turkish	Clinical rct	Cone-beam computed tomography (cbct)	Fused roots , c-shaped canal anatomy and four canals.
2015	Dosunmu <i>et al.</i> <sup>18</sup>	Nigerian	Clinical rct	Radiographic and clinical examination	Two roots
2017	Ring <i>et al.</i> <sup>19</sup>	USA	Clinical RCT	Cone-beam computed tomography (cbct)	2 Roots and 3 canals.
2018	Paul <i>et al.</i> <sup>20</sup>	India	Clinical rct	Radiographic and clinical examination	Three Canals
2018	Bertrand <i>et al.</i> <sup>21</sup>	USA	Clinical RCT	Cone-beam computed tomography (cbct)	Four Canals

Series of case reports were published in various literatures with the variations in roots and root canal configuration of mandibular second premolars (Table-1)

Vertucci and Zillich *et al* in study on anatomical and morphological configuration reported two canals in only 2.5% and the occurrence of three canals has been suggested to be 0.5% and 0.4%, respectively. [5,6]

The purpose of this case report is to describe the diagnosis and endodontic management of a mandibular second premolar with Sert S & Bayirli GS Type XVI (2-3) canal configuration with two roots and three distinct root canals and to highlight the benefits of CBCT imaging.

### Case Report

A 34-year-old male patient reported to OPD of Department of Conservative Dentistry and Endodontics, with a complaint of severe toothache during mastication in mandibular right posterior region of jaw. The patient gave a history of continuous dull, gnawing pain. Intraoral examination, confirmed the presence of restoration on occlusal surface with tooth #45, and tenderness on vertical percussion was present. Electric pulp test was positive and cold test showed delayed response.

Radiographically, disto-occlusal radiolucency was seen involving pulp, and periodontal widening was present in the apical third [Figure 1a]. A diagnosis of symptomatic irreversible pulpitis with symptomatic apical periodontitis was made. The treatment plan decided was endodontic treatment followed by prosthetic rehabilitation.

Local anesthesia was administered and isolation was done with rubber dam. Complete carious removal was done and distal wall build was done with glass ionomer. The access cavity preparation was done under Dental loupes and canals were accessed with #10 K file (Mani Inc. Japan). Two separate orifices were identified (mesial and distal) and on further probing an additional distal canal (Distolingual) was located from the same distal orifice. Working Length was achieved with the apex locator (Root ZX, J.Morita Inc., USA) and radiograph was taken [Figure 1b]. Sterile cotton was placed in the pulp chamber, and the access cavity was sealed with Cavit (ESPE, Seefeld, Germany). A cone-beam computed tomographic (CBCT) was advised to confirm the findings and to rule out another anatomic variation. CBCT confirmed the finding of 2 roots (Mesial and distal) and 3 canals (1

Mesial, 1 Distobuccal, and 1 Distolingual) in right mandibular second premolar (Figure-2)

Cleaning and shaping were performed using Endostar E3 Azure File system (Endostar) with the crown-down technique. All canals were enlarged upto 4% taper to size 25. The root canals were frequently irrigated with 2.5% sodium hypochlorite (Prime Dental Products, Thane, India), normal saline and 17%EDTA (Pulpdent Corporation, Watertown, MA), as the

final irrigant. Irrigant agitation was done with the help of manual gutta percha points. The canals were dried with absorbent paper points (Dentsply Maillefer. The master cone, (#25/.04) gutta-percha, (Dentsply Maillefer, Switzerland) was inserted to the full working length and apical snug fit was checked. [Figure 1c]. The master cones were coated with sealer (AH Plus® Sealer -Dentsply, Tulsa Dental Specialties, Tulsa, OK) and placed in canal and 3D Obturation was done using thermoplasticized Technique. Tooth was then restored by composite restoration (Filtek Z350 XT Universal Restorative, 3M India), and post treatment radiographs were taken. [Figure-1d]

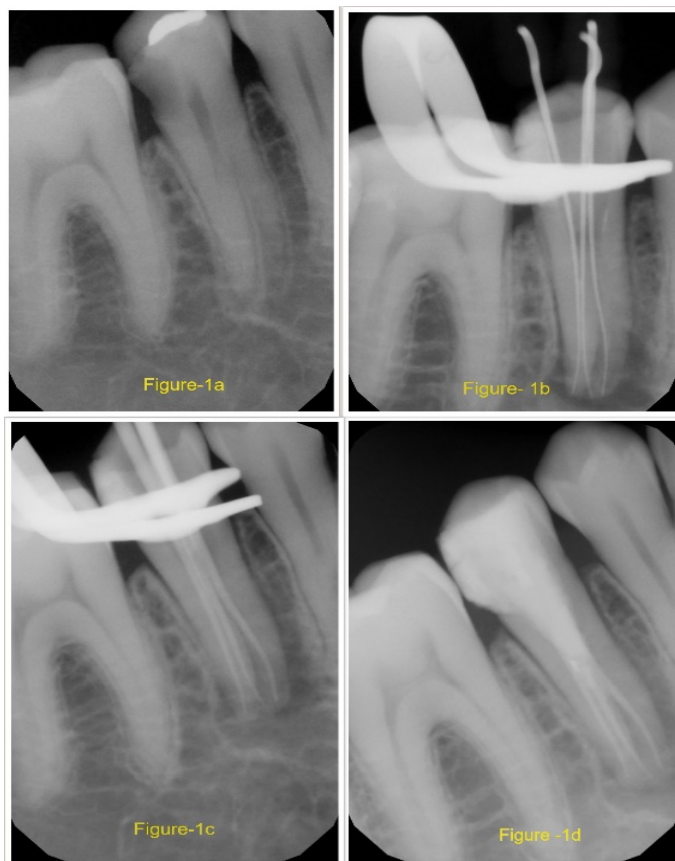


Figure 1a: Preoperative IOPA

Figure- 1b: Working length IOPA

Figure 1c: Master cone fit IOPA

Figure 1d: Post obturation IOPA

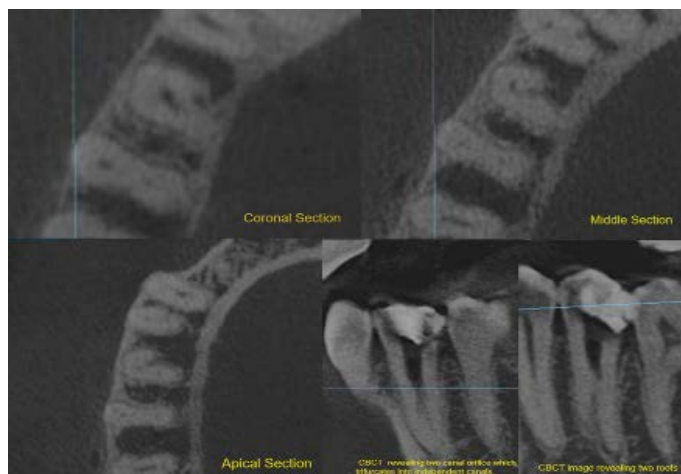


Figure 2: CBCT imagery of tooth #45 revealing three canals

### Discussion

Mandibular second premolar are often considered as enigma to the endodontist as root morphology and canal

morphology are extremely complex and highly variable when compared to any other tooth in the oral cavity [22].

In clinical conditions, diagnosis of such variant root canal anatomy clinically starts from first step that is preoperative intraoral periapical radiographs taken in different angulations which is an essential part of endodontic treatment for the identification of root and canal configuration; however, they give only 2-dimensional information about a 3-dimensional object. Leonardi Dutra et al, 2016 in meta-analysis, concluded that CBCT radiography yields excellent diagnostic accuracy as compared to that of conventional radiography, making it easier for the clinician to complete the endodontic triad.[23]

Advanced endodontic equipment's, particularly dental operating microscope (DOM) and dental loupes are recommended as helpful in easy location of such aberrant root canal system. In this case root canal orifices were explored and negotiated under magnification of loupes which suggests that it can be a great tool in successfully treating the cases with different anatomical variations.

The presence of additional canals in mandibular second premolar has been reported frequently by many researchers. Kottoor et al, 2013 in review of the literature,[4] reported an incidence of 2 roots was present 0.61% cases, whereas the incidence of more than 2 roots was present 0.01% of the time. In the same study, incidence of 2 canals was reported to be 12.64%, whereas incidence of more than 2 canals was reported as 0.31%. ElDeeb was the first to do nonsurgical endodontic treatment of mandibular second premolar with three canals [24]. A maximum of 5 canals have been reported in mandibular second premolar till date [25]. The present case describes Sert S & Bayirli GS Type XVI (2-3) canal configuration where two canals are present mesial and distal, and the distal canal bifurcates in to two canals at

middle third of root and exit as three separate orifices at the apex.

### **Conclusion**

The successful and predictable endodontic treatment can be influenced by multiple factors such as through anatomical knowledge, constructive diagnosis with the help of advanced diagnostic tools, and application of skillful equipment in the completion of an uneventful treatment. The clinician should anticipate the presence of unusual numbers of roots and the phenomenal aberrations in the morphology of mandibular premolars. Newer diagnostic techniques like CBCT imaging and a dental Loupes help in the detection of such abnormalities and the eventual success of endodontic therapy

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