



## MANAGEMENT OF ATYPICAL ANATOMY IN MANDIBULAR FIRST PREMOLARS IN INDIAN POPULATION –A CASE REPORT

### Dental Science

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### ABSTRACT

Variation in root canal anatomy accounts for the highest failure rates in mandibular premolars. Successful root canal treatment in these teeth, commonly referred to as endodontic enigmas, requires profound knowledge of variations in basic morphology, modern diagnostic aids and clinical acumen. This paper presents a review on occurrence of different canal configurations of mandibular premolars especially in Indian population. It also presents a series of successfully treated anomalous premolars where all the extra canals were located, cleaned and shaped to obtain a successful outcome with an excellent post-operative healing.

### KEYWORDS

Mandibular premolar, Anatomic variation, RCT

### INTRODUCTION:

Knowledge of the basic morphology of the root and root canal system of teeth as well as possible anatomic variations is imperative for successful outcome of endodontic therapy. Operator's inability to realize these variations in root canal anatomy has been suggested as the most likely reason for the high frequency of endodontic flare ups and failures. Hoen and Pink found a 42% incidence of missed roots/canals in the teeth that needed re-treatment.<sup>[1]</sup> Also, among all the teeth, mandibular first premolar exhibited the highest failure rate of 11.45%.<sup>[2]</sup>

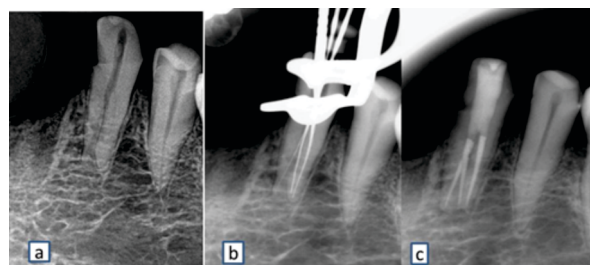
More often than not, mandibular premolars have been treated endodontically under the assumption of possessing single root and single canal, however this is more of an exception than a rule.<sup>[3]</sup> Incidence of number of roots and root canals in mandibular premolar shows a lot of variations and anomalies quite contrary to the popular belief.<sup>[4]</sup> Slowey has indicated that probably because of the complex root canal anatomy, the mandibular premolars are the most difficult teeth to treat endodontically and are often referred to as endodontic enigmas.<sup>[5]</sup>

The objective of the paper is to present two such cases of complex anatomy for establishing guidelines in identification and successful treatment of such anomalous mandibular premolars while reviewing the literature regarding the variation in root canal anatomy of the human mandibular first premolar especially with respect to Indian population.

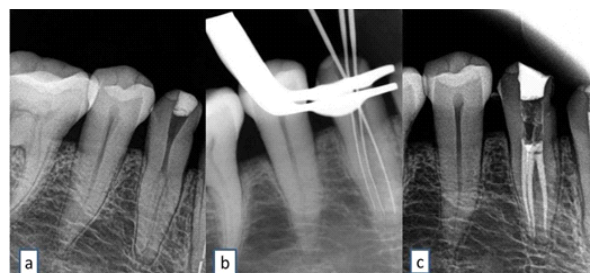
### Case report

**Case 1:** A 35 year old patient was referred for root canal therapy in 34 and 44 with the diagnosis of symptomatic irreversible pulpitis after tooth preparation for fixed prosthesis for replacement of lower anterior teeth. The diagnostic IOPA radiographs of 34 and 44 (Fig 1a, Fig 2a) suggested atypical root canal anatomy and hence horizontally angulated radiographs were repeated which provided a better confirmation of canal anatomy for both the premolars. After attaining profound anesthesia and rubber dam isolation, access cavities were prepared using Endo access and Endo Z bur. Modification in the access cavity for orifice location was done using Start X ultrasonic tips (No.1 and No.2, DENTSPLY) at 6X magnification under an operating microscope. Two orifices were initially identified in each of the teeth, one lingual and one buccal, which were enlarged and oriented for straight line access using X-Gates (DENTSPLY). An additional orifice was located buccally in both the teeth using the same ultrasonic tips for troughing along the dentinal map. Scouting of all canals for patency revealed three separate foramina in each of tooth suggesting a rather rare Vertucci type VIII (3-3) root canal anatomy. Bleeding into the pulp chamber was initially controlled by irrigating copiously with 5.2%NaOCl. Working length was determined using an apex locator

(Canal Pro, COLTENE) which was then confirmed radiographically (Fig 1b, Fig 2b). The three canals were then sequentially instrumented using controlled memory files (HyflexCM, COLTENE) along with intermittent irrigation using 3% NaOCl. Final apical size was confirmed based on apical gauging. Cleaning was performed by irrigating with 17% EDTA, 3%NaOCl and normal saline using a sonic agitation device (Endoactivator, DENTSPLY). The access cavities were temporized with Cavit (3M, ESPE). On the next visit, obturation was done with matched taper cones using Roeko seal sealer (Coltene). Post obturation radiograph was taken for assessment of obturation and record keeping (Fig 1c, Fig 2c).

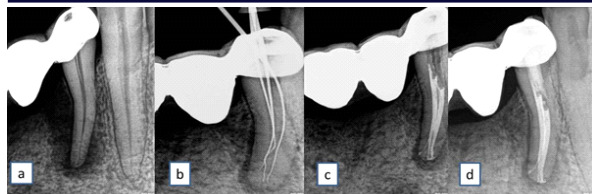


**Fig 1a: Preoperative view of #34 Fig 1b-Working length determination of #34 Fig 1c- Post obturation radiograph of #34**



**Fig 2a: Preoperative view of #44. Fig 2b-Woking length determination of #44 Fig 2c-Post obturation view of #44**

**Case 2:** A 30 year old patient presented with a sinus in relation to tooth 44(FDI) which served as an abutment for a fixed partial denture. Preoperative radiographic examination revealed lateral and periapical radiolucency in relation to root apex of the tooth (Fig 3a). After access cavity preparation, three different portals of exit were identified through two orifices using No.8 and 10 K files. Apex locator was used to determine the working length. A radiograph was taken to confirm the presence of three portals of exit (Fig 3b).



**Fig 3a: Preoperative view of #44. Fig 3b-Working length determination of #44 Fig 3c-Post obturation view of #44 Fig 3d-Healing after four months**

The canals were shaped sequentially using Proglider and Hyflex CM rotary files. Irrigation was performed using 3% sodium hypochlorite and 17% EDTA to dissolve necrotic pulp and remove smear layer. A dedicated 30 minutes were spent on cleaning the root canals while the agitation of irrigants was carried out using manual dynamic agitation. The canals were dried with paper points and the access cavity was temporized. At the second appointment, the canals were obturated using Guttaflow Bioseal sealer and Gutta-percha cones (Dentsply/Maxillier, USA) (Coltene/Whaledent, Langenau, Germany) (Fig 3c) and the cavity was restored with composite. On recall appointment after four months, healing could be observed in the periapical tissues (Fig 3d).

### DISCUSSION:

The root and canal morphology of the mandibular first premolars can be extremely complex and highly variable. Studies have emphasized on the fact that a root with tapering canal and a single foramen is an exception rather than a rule.<sup>[5a]</sup> The incidence of the number of roots and of the number of canals reported in anatomic studies varies greatly in the literature. The factors associated with this variation are multifold and include variation in ethnicity, age, gender, unintentional bias in the selection of patients or teeth (specialty endodontic practice vs. general dental practice) as well as study design (in vitro vs. in vivo).<sup>[7]</sup>

Iyer et al, Geider et al and Shulz et al have reported 3.9%, 6.4% and 0.7% of mandibular first premolars having two or more roots respectively.<sup>[4]</sup> Zillich and Dawson reported that a second or third canal existed in at least 23% of mandibular first premolars.<sup>[8]</sup> The prevalence of three root canals with three orifices was reported to be 0.4% by El Deeb. However, only 0.46% of the first and second premolars exhibit a three canal and three foramen configuration. Iyer VH et al documented a 3.2% incidence of bilateral occurrence of these anatomical complexities in the mandibular premolars.<sup>[4]</sup>

Jain A et al reported that 88.40% of mandibular premolars presented with one orifice whereas two orifices were found in 11.59%. The shape of the canal orifice was found to be round in 33.33%, oval in 52.17% and flattened ribbon in 14.40%.<sup>[9]</sup> Sandhya R et al reported 80% incidence of single canal, 11% of two canals and 2% of C shaped canals in her study on mandibular premolars in Indian population.<sup>[10]</sup>

Iyer V H et al found an astonishing 24.6% anatomical variance in the canal configuration of mandibular premolars in native Chennai population. High incidence reported was of Vertucci's Type IV canal configuration as compared to Type V, Type II and Type VIII in the descending order of occurrence.<sup>[11]</sup> Another study done by Somani MC et al in Western Indian population including 200 mandibular premolars found that Vertucci Type I accounted for only 65% occurrence followed by a 15% occurrence of Type III and an 8% Type V canal configuration.<sup>[12]</sup>

Though conventional intraoral periapical radiographs do not necessarily reveal the true picture but may present with subtle hints suggestive of varied canal anatomy. Fast break appearance of canal, lateral progression of periapical lesion, eccentric position of file during treatment and sudden resistance to file movement, all point towards atypical canal anatomy. Conventional images do not present a three dimensional picture and leave much on the operator's diagnostic abilities and experience.

The introduction of cone beam computed tomography (CBCT) in the field of endodontics has provided the clinicians with a non-invasive three-dimensional confirmatory diagnosis as a complement to conventional radiography with the additional advantages of substantial reduction in radiation exposure and higher quality image

rendering for assessment of dental hard tissue.<sup>[13]</sup>

Although CBCT maybe an indispensable adjunct in the management of complex cases, however the importance of conventional radiographs cannot be underestimated. Since all the cases cannot be advised for CBCT, a careful interpretation and appraisal of a conventional radiograph may hint the presence of an aberration in the canal anatomy. Additional radiograph at 15° to 20° angulation from the horizontal axis were taken which indicated presence of more than one canal.

Yoshioka et al. have indicated that sudden narrowing of the canal system on radiograph suggests canal system multiplicity.<sup>[14]</sup> Martinez Lozano et al. have suggested a 40° mesial angulation of the X ray beam to identify additional canals.<sup>[15]</sup> A general guideline is that if the mid root image diameter appears equal or greater than the crown image diameter, the tooth most likely has a variation in root canal configuration (Miyoshi et al., 1977).<sup>[16]</sup>

The presence of additional canal can also be suspected if an instrument demonstrates an eccentric direction i.e. it is off centered on deeper penetration into the canal, termed as directional control, as reported by Green (1973).<sup>[17]</sup>

### CONCLUSION:

This case series highlights the fact that even in the absence of advanced imaging techniques, successful endodontic management of anomalous cases can be carried out by a keen analysis of conventional radiographs and dental map, usage of surgical microscope which causes a several manifold increase in the visibility of field of operation, use of apex locators, a combination of rotary and hand filing techniques and last but not the least, patience of the operator.

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