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Research Article

MANAGING A MANDIBULAR SECOND PREMOLAR WITH THREE-CANAL AND TAURODONTISM: A CASE REPORT

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A B S T R A C T

Taurodontism is a morpho-anatomic variation in tooth anatomy that rarely affects mandibular premolars. Mandibular 2nd premolars are considered as enigma to the endodontist, because of their wide variation in root canal & morphology. Proper negotiation and treatment of such cases is very important, failure to do such may results in loos of tooth. Incidence of such morpho-anatomic variation including three separate roots along with taurodontism is a rare condition and very few cases have been reported in literature so far. The novel diagnostic aids like cone beam computed tomography (CBCT) facilitates diagnosis. Such tooth requires exceptional and diligent care in each segment of endodontic treatment. This article describes the successful management of the left mandibular second premolar with taurodontism and three separate roots diagnosed using CBCT.

INTRODUCTION

The root canal system is always complex and variable.[1]The operator must have a thorough knowledge of such a complex system for successful endodontic treatment. If such anatomy left undetected, it may result in the failure of endodontic treatment.[2] The main goal of endodontic management is completely chemical and biomechanical preparation of root canal system, followed by three-dimensional obturation with an appropriate filling material and a final coronal restoration to prevent microleakage.[3] Dental anomalies comprise a great part of tooth morphology discrepancies; one of the most important abnormalities in tooth morphology is taurodontism.

Taurodontism can be defined as a change in tooth shape caused by the failure of Hertwig's epithelial sheath diaphragm to invaginate at the proper horizontal level. The characteristic features comprise an enlarged pulp chamber, apical displacement of the pulpal floor, and no constriction at the level of the cementoenamel junction. Different diagnostic criteria and racial variations presented the wide range of variability of prevalence from less than 0.1% to 48%.[4] Taurodontism is an anomaly of multirooted teeth, sometimes bilateral[5,6] and sometimes multiple[6, 7] characterized by enlargement of the apical portion of the pulp chamber. Although some authors have studied it as a retrograde or primitive feature, it has been reported with increasing frequency in present-day man.[8, 9]Taurodontism can occur as a separate anomaly or maybe in associated with certain diseases like hypophosphatasia,[10] or alterations of the sex chromosomes, such as Klienfelter's Syndrome,[11] trisomy of 21,[9] or Down's syndrome, X-Chromosome aneuploid Syndrome[12], with ectodermal defects[13], etc. A certain familial tendency has been reported in the presentation of taurodontism. Taurodontism is seen more commonly in molars, whereas its incidence in premolars is very low. To consider premolars to be taurodont, they must have a lower cervical constriction, a broad, prism-shaped root with cervical and apical thickening, a dilated bifurcated and slightly concave root and enlargement of the pulp chamber with root bifurcation.[14-16]

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A literature review of such anomaly reveals wide variations and diversities in the root canal anatomy of mandibular premolars. Madeira *et al*. (1986) conducted a study on the prevalence of taurodontism in premolars and concluded that its overall incidence was 0.25% with the highest prevalence in mandibular first premolars (0.42%) and the lowest in maxillary premolars (0%).[16] Mandibular premolars mostly have a single root and root canal. Zillich and Dawson (1973) reported an incidence of two or more roots in 2.1% and 0.4% of mandibular first and second premolars, respectively.[17] We wish to emphasize the need for recognition of such an uncommon dental anomaly, as it poses difficulties in deciding the type of endodontic treatment and in performing the same when required.

This rare case report presents the successful nonsurgical endodontic treatment of a taurodontic mandibular left second premolar with three separate roots, using cone-beam computed tomography (CBCT) as a confirmatory diagnostic tool.

Case Report

A 12-yearmale patient reported to Department of Pediatric & Preventive Dentistry with the chief complaint of severe pain in the lower left posterior jaw region from 2 days. Intraoral examination revealed deep occlusal caries in with relation to # 35. The tooth was painful to vertical percussion and showed an exaggerated response on cold and electric pulp testing. Radiological findings showed coronal radiolucency involving pulp, widening of apical periodontal ligament (PDL) spaceand large pulp chamber without any constriction at cementoenamel junction, and roots trifurcating at the apical third (fig 1a). A periapical radiograph of contralateral tooth # 45 showed presence of single root and root canal system, which ruled out the presence of anomaly on contralateral side. Based on clinical and intraoral periapical radiographic findings, the patient was referred to an oral and maxillofacial radiologist for a cone-beam computed tomography. Informed consent was obtained from the patient and a CBCT of the mandible was performed. A three-dimensional image of the mandible was obtained. The involved tooth was focused, and the morphology was obtained in transverse, axial, and sagittal sections with a thickness of 0.48 mm, along with three-dimensional reconstructed images (Fig 2). The condition was diagnosed as acute irreversible pulpitis with apical periodontitis in a taurodont premolar with trifurcation, and root canal therapy was planned.

Administration of local anesthesia was followed by rubber dam placement. Access cavity was prepared, and inflamed pulp tissue was removed using barbed broaches. Careful exploration of pulp chamber floor with DG 16 explorer and magnification loupes revealed the presence of three orifices: One mesially (mesiobuccal), one distally (distobuccal), and another lingually (lingual), canals were negotiated using # 10 K file. Working length was estimated using intraoral periapical radiograph (Fig 1c) and verified with an apex locator (Root ZX, J Morita Inc., USA). The root canal system was cleaned and shaped using hand K-files, using 3% sodium hypochlorite and 17% ethylenediamine tetraacetic acid (EDTA). The root canals were dried with sterile paper points and filled with calcium hydroxide paste; then, access cavity was temporarily sealed with Cavit (3M ESPE AG, Seefeld, Germany). The patient was scheduled after one-week follow up. The tooth was completely asymptomatic at this follow-up. Calcium hydroxide paste was removed by copious saline irrigation. Canals were dried using sterile paper points and the apical third of roots canals were obturated by cold lateral compaction of gutta-percha using ZOE sealer and the pulp chamber was obturated with thermoplastic gutta percha(Calamus 3D Obturation system). A postoperative radiograph was taken (Fig 1d), and the access cavity was restored permanently with composite restorative material.

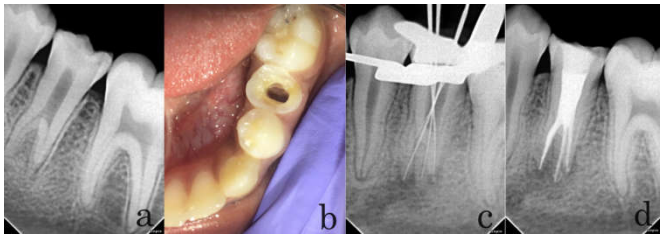

Fig 1. Showing(a) Preoperative intraoral diagnostic radiograph of tooth #35; (b) Clinical photograph of access opening preparation; (c) working length radiograph showing three canals; (d) Postobturation radiograph and coronal seal with composite restoration.

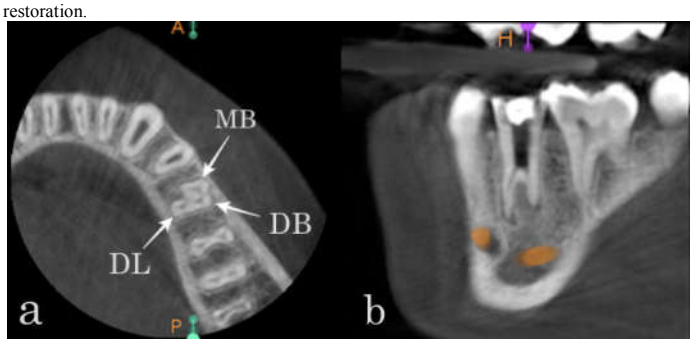

Fig 2 Oblique (a) & axial (b) views CBCT images of tooth#35

DISCUSSION

Taurodontism has diverse possible causes including failure of invagination of the epithelial root sheath sufficiently early to form a cynodont. It may also present as a variant of the pulp chamber form, which may or may not arise as a result of abnormal dentin development.[18]Taurodontism is seen more commonly in molars, whereas its incidence in premolars is very low.A study by Madeira *et al* of 3,449 lower premolars found seven taurodont first premolars and four taurodont second premolars but none among 1,010 upper premolars.[16] In the Indian population, Moayedi and Lata reported a case of mandibular premolar with three root canals and three apical foramina, but taurodont was not confirmed.[19]

Taurodontism, although not common, is an important occurrence that may influence dental management of patients.Taurodont teeth may presents apically positioned canal orifices, complex root canal anatomy, and varying degrees of obliteration in root canals, which needs to be considered during treatment.[20]

The root canal system of mandibular second premolar is complex and unpredictable, and such complex anatomy may contributes to endodontic failure.[21-23]Radiographs show 2 dimensional images, resulting in the superimposition of images, whichobscuring the complete visual of complex root canal anatomy Cases. The introduction of three-dimensional imaging techniques such as CBCT, dental operating microscope/loupes, fiber optic transillumination as well as current developments in root canal instrumentation, and obturation procedures made this challenging task quite easy. The CBCT images in this study revealed three separate roots

(one mesial and one distobuccal and one distolingual) with three distinct root canals. Each of the root canals had separate apical orifice. Although the vague outlines of the three roots could be observed on the radiograph, the confirmatory diagnosis of the taurodontism and three root canals were done with the help of radiograph and CBCT.

Often taurodont form does not interfere with operative procedures; however, endodontic therapy may be more difficult because of its morphology. The long rectangular shape of pulp chamber seems to cause difficulty in locating the canal orifices. The close proximity of the root canal orifices in the limited width of the pulp chamber floor that was located deep in the apical third of the root trunk was the chief endodontic challenge. Rotary instrumentation was not used in the apically located root canals, rather hand instrumentation was preferred as taurodont roots with small width may increases the chances of dentinal crack formation and subsequent fractures.[20] During biomechanical preparation only apical third of file were used which was time consuming. Due to such typical anatomy, where buccal canals wereclose and deeply placed in the tooth, the obturation was different from conventional one. It was difficult to obturate such canals with single method of obturation; therefore a combination of lateral condensation and warm vertical condensation technique was preformed for best results. The obturation of three canals was done with lateral condensation technique while the taurodontic pulp chamber space was obturated using the thermoplastic gutta-percha system (Calamus 3D Obturation system). The endodontic cavity was permanently restored with composite restorative material. Follow-up after 3 months confirmed the endodontic healing of this three-rooted hypertaurodontic premolar.

CONCLUSION

Using periapical radiographs alone could not depict exact root canal anatomy. Mandibular premolars have a high failure rate due to their extreme variations in root canal anatomy. Novel imaging modalities such as CBCT, magnification, modified obturation, and post endodontic restorative techniques aids in the successful management of these rare cases. The success of this case might be attributed to accurate diagnosis, complete chemo-mechanical debridement, and proper obturation of all the three root canals.

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