ANAMOLOUS MANDIBULAR PREMOLARS AND THEIR MANAGEMENT

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Abstract: Successful endodontic treatment requires effective biomechanical preparation and three-dimensional obturation of the root canal system. To achieve this, the clinician must have a thorough understanding of normal anatomy, and of common variations from the norm. The clinician must also be prepared to identify those teeth that tend to vary greatly from the norm, e.g. mandibular premolars. There is abounding literature of mandibular premolars presenting aberrant root canal anatomy. Endodontic treatment of a taurodont tooth is challenging and requires special handling because of an enlarged pulp chamber and apical displacement of the roots. Accurate diagnosis with novel diagnostic aids like cone beam computed tomography (CBCT) assist in increasing the success rate of nonsurgical endodontic treatment.

This article describes the successful management of the mandibular premolars with different root canal anatomy.

Key words: Cone beam computed tomography, taurodontism, mandibular first premolar, mandibular second premolar.

I. INTRODUCTION

Knowledge of the morphology of the root and root canal systems of teeth and diagnostic imaging techniques are required for successful root canal treatment, especially in mandibular premolar teeth¹. Anomalous root and root canal morphology can be found associated with any tooth with varying degrees and incidence. Mandibular premolars have on multiple occasions been stated to be the most challenging teeth to be treated endodontically. Kotoor et al summarized that lower bicuspids were commonly found to have a single root (greater than 97%) with the mandibular first premolars being comparatively twice more likely to present with two canals (23.55%) than second premolars (12.64%). Multiplicities of roots (up to 4 roots) and root canals (up to 5 canals) have been documented as case reports in both lower bicuspids.²,³

Dental anomalies constitute great part of tooth morphology variations. One of the most important abnormalities in tooth morphology is taurodontism. Taurodontism is an atypical morphoanatomic variation, defined as a change in tooth shape caused by the failure of Hertwig’s epithelial sheath diaphragm to invaginate at the proper horizontal level. It exhibits three characteristic features such as enlarged pulp chamber with apical displacement of the pulpal floor, and no constriction at the level of the cementoenamel junction.⁴,⁵
Taurodontism was first reported by Gorjanovic–Kramberger in 1908.5 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%).6,7

The presence of three canals in mandibular premolar and taurodontism is exceptional and its endodontic treatment is undoubtedly challenging. These clinical case reports present successful nonsurgical endodontic treatment of a taurodont mandibular first and second premolar wherein cone-beam computed tomography (CBCT) was used as a confirmatory diagnostic tool.

Case Report 1:
A 23-year-old female patient walked into our clinic with chief complaint of severe shooting pain related to lower left side of her face over a period of one week. Patient also complained of episodes of sensitivity to hot and cold foods in mandibular left second premolar tooth. On clinical examination, deep carious lesions were observed in 35 showing pulpal involvement and was tender on percussion. Electric pulp test (Sybron Endo, USA) and heat test with a gutta-percha stick gave a lingering response.

Preoperative periapical radiograph revealed slight widening of the periodontal ligament space at the periapical area related to the 35 and thickening of the lamina dura, with deep mesio-occlusal cavity reaching the pulp space area [Figure 1a]. It is also evident from radiograph that 35 showing severe taurodontism with bifurcated roots at apical one-third. Based on clinical and radiographic evidences, a diagnosis of irreversible pulpitis was made.

Access was gained to the pulp chamber after administration of local analgesia (2% lidocaine with 1:80,000 adrenaline) under rubber dam isolation using endo-access bur and endo Z bur. The necrotic pulp tissue was removed from entire pulp chamber and irrigated with 5.25% sodium hypochlorite solution. Careful exploration of pulp chamber floor done with #8 and #10 k- files and usage of loupes revealed the presence of three canals: mesio-buccal, disto-buccal and lingual. Working length determination was estimated using apex locator and confirmed with intraoral periapical radiograph [Figure 1b]. The biomechanical preparation was done using k- type hand files till master apical file #30 under copious irrigation with 5.25% NaOCl and 17% EDTA alternatively with in between saline irrigation. Later suitable master cones were selected [Figure 1c] and sectional obturation was done by shearing off the GP cones till the canal orifices at the bifurcation of root. Remaining portion of pulp chamber was obturated with thermoplasticized GP and AH Plus sealer (Dentsply) using calamus unit. Post endodontic restoration was done with composite {Filtek P60 Posterior restorative (3M ESPE)} [Figure 1d].

Case Report 2:

Figure 1: (a) Pre-operative diagnostic radiograph (b) Working length radiograph (c) Master cone radiograph, (d) Postobturation radiograph and coronal seal with composite resin.
A 27-year-old male patient walked into our clinic with the chief complaint of pain in the right posterior region of lower jaw since 1 month. Patient gives a history of root canal treatment done in same region 1 year back. On clinical examination there is partially dislodged post endo restoration in relation to 45 and the tooth was sensitive to percussion. Radiological findings showed incomplete obturation and roots bifurcating at the middle third. The condition was diagnosed as apical periodontitis in a taurodont premolar and re- rct was planned. It is also evident that premolar in adjacent quadrant (35) showing same anomalous pattern of taurodontism with bifurcated roots [Figure 3d].

Local anesthesia (2% lidocaine with 1:80,000 adrenaline) was administered followed by rubber dam placement. The partially dislodged post endo restoration is removed followed by retrieval of obturating material using ProTaper re- treatment files. Careful exploration of pulp chamber floor with DG 16 explorer and loupes revealed the presence of three orifices: One mesially (mesiobuccal), one distally (distobuccal), and another lingually (lingual). The distobuccal orifice was missed during previous root canal treatment. The canal orifices were enlarged with Gates–Glidden drills, working length was estimated using intraoral periapical radiograph [Figure 3a]. The biomechanical preparation was done using Protaper Universal Niti rotary system (Dentsply, USA) up to size F2 under copious irrigation with 3% NaOCl. Commercially, available paste form of calcium hydroxide (RC Cal, Prime Dental Products, India) was placed inside the root canals; access cavity was sealed with cavit and patient recalled after a week. Further, the patient was referred for cone beam computed tomography (CBCT) examination to confirm the observed findings and also to explore any additional findings if present like any unexplored canals.

CBCT examination confirmed the presence of taurodontism bifurcating into two roots with three root canals which are separate at coronal one third but mesiobuccal and distobuccal canals fused at middle one third to exit as a single foramina. [Figure 4 a, b and c]. On recall, calcium hydroxide was removed from the root canals, and suitable master cones were selected [Figure 3b] followed by obturation using F2 Protaper GP points and AH Plus sealer (Dentsply). Later postendodontic restoration was done with composite {Filtek P60 Posterior restorative (3M ESPE)} [Figure 3c].
Case Report 3:
A 23-year-old female patient walked into our clinic with chief complaint of severe shooting pain related to lower left side of his face over a period of one week. Patient also complained of episodes of sensitivity to hot and cold foods in mandibular left first premolar tooth. On clinical examination, deep carious lesions were observed in 34 and 36 showing pulpal involvement and was tender on percussion. Electric pulp test (Sybron Endo, USA) and heat test with a gutta-percha stick gave a lingering response.

Preoperative periapical radiograph revealed slight widening of the periodontal ligament space at the periapical area related to the 34, with deep occlusodistal cavity reaching the pulp space area [Figure 5a]. It is also evident from radiograph that 35 having taurodontism with bifurcated roots. Based on clinical and radiographic evidences, a diagnosis of irreversible pulpitis was made. Access was gained to the pulp chamber after administration of local analgesia (2% lidocaine with 1:80,000 adrenaline) under rubber dam isolation using endo-access bur and endo Z bur. The coronal necrotic pulp tissue was removed and the chamber irrigated with 3% sodium hypochlorite solution. Careful exploration of pulp chamber floor with DG 16 explorer and loupes revealed the presence of two orifices: buccal and lingual. The canal orifices were enlarged with Gates–Glidden drills, working length was estimated using intraoral periapical radiograph [Figure 5b]. The biomechanical preparation was done using Protaper Universal Niti rotary system (Dentsply, USA) up to size F2 under copious irrigation with 3% NaOCl. Commercially, available paste form of calcium hydroxide (RC Cal, Prime Dental Products, India) was placed inside the root canals; access cavity was sealed with cavit and patient recalled after a week. On recall, calcium hydroxide was removed from the root canals, and suitable master cones were selected [Figure 5c] followed by obturation using F2 Protaper GP points and AH Plus sealer (Dentsply). Later postendodontic restoration was done with composite (Filtek P60 Posterior restorative (3M ESPE)) [Figure 5d].

II. DISCUSSION
These case reports illustrates unusual morphology of the roots and root canal systems of the mandibular premolars. Human mandibular premolars have earned the reputation for having an extremely complex root and root canal morphology. In 1979, Slowey reported that root canals are frequently left untreated because clinicians often fail to identify their presence, particularly in teeth that have anatomical variations or additional root canals.8,9 Tzanetakis et al. have reported endodontic management of mandibular second premolar with four root canals diagnosed with the aid of operating microscope.10,11 Serman and Hasselgren (1992) reported a high incidence of multiple roots (18.1%)
and root canals in mandibular premolar teeth in a series of radiographic surveys with mandibular first premolars involved in 15.7% of patients and mandibular second premolars in 7% of patients.\textsuperscript{12}

Durr et al. stated that in taurodont teeth, morphology could hamper the accessibility of orifices. A modification in the access cavity preparation is often needed for unhiding the additional orifices of the root canals or the orifices of the extra roots for a better instrumentation. Careful exploration of grooves between the orifices, using dental operating microscope or magnifying loupes is recommended to reveal additional orifices. An additional canal should be suspected whenever there is a sudden narrowing of root canal system or if the working length file appears off center in the radiograph. Good preoperative radiographs taken in two or three angulations, and careful interpretation of root outline and PDL space helps in identifying extra roots.\textsuperscript{15} Martinez-Lozano et al. recommend up to 40° mesial angulation from horizontal as more reliable in identifying the extra canals. Deviation of the X-ray angle from the vertical axis of 15° to 30° was effective only in the mandibular first premolar in helping to visualize canal anatomy.\textsuperscript{16}

Analysis of dentinal map and color change on the floor of pulp chamber also help in the detection of extra canals. Orifice enlargement and preflaring reduces curvature and produces a straight line access to curved apical portion. The more apically a root canal divides, more difficult it is to access and obturate; therefore, care should be taken to maintain patency during obturation.\textsuperscript{17}

The advent of three-dimensional imaging techniques such as CBCT, dental operating microscope/loupes, fiber optic transillumination as well as recent developments in root canal instrumentation, and obturation techniques made this challenging task quite simple. The introduction of CBCT resulted in a paradigm shift in the field of endodontics. The sagittal, coronal, and axial CBCT images provide three dimensional imaging with relatively lower effective radiation doses than other computed tomography (CT) systems. CBCT images also provide an insight into the spatial relation of the anatomic variations and allow the clinician to visualize any access modifications that could be required for treatment.\textsuperscript{18}

\section*{III. CONCLUSION}

The risk of missing anatomy during root canal treatments is high due to the complexity of the root canal system in mandibular premolars. Hence, a thorough understanding of normal anatomy and common variations, careful interpretation of angled radiographs, use of three-dimensional imaging, proper access cavity preparation, and a detailed exploration of the interior of the tooth, ideally under magnification, followed by adequate cleaning, shaping, and obturation could collectively play a vital role to ensure endodontic success.

\section*{REFERENCES}