Endo- Perio management of maxillary first premolar with three distinct roots and three canals diagnosed with Cone Beam Computed Tomography– A rare case report

Pradeep Jain¹, Prashanth M. B², Anita Mishra³, Husain Riyaz Kapadia⁴

¹Professor & HOD, ²Professor, ³PG Student, ⁴PG Student, Department of Conservative Dentistry and Endodontics, Sri Aurobindo College of Dentistry, Devi Ahilya University, Indore, India.

Corresponding author
E-mail: pradeep_endodon@rediffmail.com

Abstract
Many of the difficulties found in endodontic therapy are caused by variations in root canal anatomy. Any pre-assumptions regarding the root canal morphology will eventually lead to endodontic failure. Maxillary first premolars show a considerable variation in root canal morphology but the presence of three roots is rare. The incidence shown in the literature for three rooted maxillary first premolar is 0.5 to 6%.

Endodontic–periodontal lesions offer a constant challenge to the clinician for diagnosis, treatment and prognosis. Treatment and prognosis of endodontic–periodontal diseases vary depending on the cause and the correct diagnosis of each specific condition. Management of such lesions needs a multidisciplinary approach. Use of three dimensional imaging technology like Cone Beam Computed Tomography (CBCT) has proven to be an essential tool for successful diagnosis of such lesion and higher magnification using the Dental Operating Microscope (DOM) should always be given preference during the clinical procedure.

This case report describes the treatment performed on a maxillary first premolar having three independent roots and three distinct root canals with furcation involvement. Special care needs to be taken during clinical examination, refining the access cavity, locating the orifices of the root canals on the pulp floor and cleaning, shaping and obturating all identified root canals. The tooth was successfully managed by conventional endodontic treatment and regenerative periodontal surgical intervention.

Keywords: Three rooted maxillary first premolar, Cone Beam Computed Tomography, Endo-Perio lesion

Introduction
In order to perform endodontic treatments skillfully and effectively, knowledge of tooth anatomy is mandatory. A lack of knowledge of the internal anatomy and its variations will undoubtedly lead to an error in localization, instrumentation and obturation of a root canal¹. Endodontic-periodontal lesion is a clinical manifestation of the pathologic/inflammatory inter-communication between pulpal and periodontal tissues via open structures such as apical foramina, lateral, accessory canals, and dentinal tubules. On the basis of the pathologic origin, Simon et al. ² classified endodontic-periodontal lesions into primary endodontic lesions, primary endodontic lesions with secondary periodontal lesions, primary periodontal lesions, primary periodontal lesions with secondary endodontic involvement, or true combined lesions. Formulating a differential diagnosis among combined lesions has been challenging because most often clinicians do not have a complete history of the course of disease progression³. Endodontic infection promotes periodontal pocket formation and should be regarded as a risk factor in periodontitis progression. Therefore, a primary endodontic lesion draining through the attachment apparatus should be treated initially by endodontic therapy ⁴.

Root canal is a well complicated system presenting different morphological variations in teeth.

The presented case showed a rare morphological variation with maxillary first premolar. The incidence of the two-rooted morphology was 50.6% and in case of the maxillary first premolar, three roots are found at a frequency of 0.5-6%, generally with one canal in each of the three roots⁵.⁶.⁷.⁸.⁹

Another important aspect to consider in this case report is the assertion that the main cause of failure of an endodontic treatment are incorrect canal instrumentation, incomplete obturation and untreated root canals. Limited intracanal visualization with the naked eye however should also be included as one of such cause, which as a further effect makes it imperative for the endodontist to use the Dental Operating Microscope (DOM) to ensure the proper treatment of the teeth with a complex anatomy.

This clinical case report highlights the usefulness of CBCT and DOM in accurate diagnosis and successful endodontic management of maxillary first premolar with unusual morphology of three roots and three canals followed by the management of an endodontic-periodontal lesion by periodontal surgical regenerative procedures.

Case Report
A 44-year-old male patient was referred to the Department of Conservative Dentistry & Endodontics with the chief complaint of mild pain, mobility and
bleeding from gums in upper right back tooth region. A detailed case history was recorded with non-contributory medical history. On clinical examination maxillary right first premolar was discoloured with grade II mobility. A probing depth of 5mm was present on the mesial and the distal aspects of tooth.

Tooth was not responsive to electric pulp testing (Parkell Inc. NY USA). Preoperative Radiovisiograph (RVG) of tooth #14 was suggestive of periapical radiolucency, furcation involvement and severe bone loss with complex root canal anatomy (Fig. 1). In order to confirm the root anatomy of teeth, patient was referred for CBCT (Kodak 9300) scan of the concerned area. The scan confirmed the presence of three distinct roots along with three canals and periodontal pathology involving all the root apices (Figure 2 & 3). On the basis of the clinical, radiographic and CBCT examination a final diagnosis was made as chronic apical periodontitis with pulpal involvement (Type II endo-perio lesion). Endodontic treatment followed by periodontal surgery was planned and an informed consent was taken from the patient.

Local anesthesia was administered with Lox 2% (Lignocaine 2% plus adrenaline 1:80000; Neon Laboratories Ltd.) followed by rubber dam application. Access cavity preparation was done using #2 diamond round bur under Dental Operating Microscope (Global surgical™ corporation, Unicorn Denmart) at 8X (Fig. 4). A Triangular shaped Access cavity was prepared with the base towards the buccal aspect and apex towards palatal like a maxillary molar.

Access cavity was flushed with 5% sodium hypochlorite (NaOCl) and floor of pulp chamber was examined under DOM at 8X clearly showed three distinct root canal orifices for mesiobuccal, distobuccal and palatal root canal. Patency of all the three root canal was checked using #10 K file. Working length was determined with the help of apex locator (Root ZX; Morita, Tokyo, Japan) and confirmed radiographically using #15 ISO K file (Fig. 5). Chemo- mechanical preparation was done using protaper files till size F1 along with copious irrigation.
using 5% NaOCl and saline. Master cone radiograph was taken (Fig. 6). Obturation was done using AH plus sealer (Dentsply International) and F1 size protaper gutta-percha (Dentsply Maillefer) and cavity was sealed with composite restoration (3M ESPE). An immediate post-operative radiograph was taken which showed well obturated root canal with extrusion of sealer in disto-buccal root (Fig. 7). Patient was recalled after one week for periodontal surgery. A full thickness flap was raised followed by periodontal curettage.

Osseous bone graft (dimeralized freeze dried bone matrix) mixed with PRF along with Guided tissue regeneration (GTR) collagen membrane placement was done (Fig. 8, 9, 10, 11). Followed by composite splinting (3M ESPE) on proximal aspect with tooth #13, 14 and 15. Post-operative instructions were given to the patient. Patient was recalled after a week for the suture removal and checkup was done, patient was completely asymptomatic.

Fig. 5: Radiographic determination of the working length

Fig. 6: Master cone selection confirmed with radiograph

Fig. 7: Immediate post obturation radiograph showing the extrusion of sealers

Fig. 8: Full thickness flap reflected
Patient was kept on regular follow up every three months. After a period of 9 months probing depth was reduced to 3 mm and mobility was reduced to grade I (Fig. 12).

**Discussion**

Successful and predictable endodontic treatment requires knowledge of biology, root canal anatomy, and careful radiographic evaluation, in order to determine number of roots and root canals. Preoperative parallel radiographs, as well as mesial or distal angled radiographs, can help to determine the number of roots. Care should be taken when there is a sudden change in the radiographic density of the root canal space (narrowing or even disappearing) that could suggest a second root canal or more. Indistinct definition of root anatomy on several radiographs probably indicates a second root, or possibly more. According to Leonardo, an inability to detect, locate, negotiate and instrument all root canals may lead to endodontic failure. Other advanced diagnostic devices such as surgical microscopes, illumination loupes, fiber-optic trans-illumination, CBCT etc. can also be utilized as an adjunct in enhanced search of root canal system.

Maxillary premolar teeth demonstrate considerable anatomic variations in morphology and number of roots. Although this tooth is most commonly double rooted, with one buccal and one palatal root and each with one canal at the apex, reports in the dental literature describe the presence of three independent roots for this tooth, with an incidence ranging between 0% and 6%. Ingle, described one root in 43% of cases, two roots in 55% and only 2% with three roots. According to Carns and Skidmore, only 6% of maxillary first premolars...
showed three roots containing three canals with independent apices. In a study by Vertucci and Gegauff, 69% of the first maxillary premolars displayed two canals at the apex, 26% with only one root canal, and 5% with three canals at the apex. Sion and Kaufman, reported an incidence of 5% of maxillary first premolars with three independent root canals. Kartalet al reported an incidence of 89.64% for two canals (from type II to type VII), 8.66% for type I canals (one root canal), and only 1.66% of maxillary first premolars were type VIII or type IX (three canals).

The dental operating microscope (DOM) plays an important role in diagnosis, locating the additional canal orifices of the tooth, retreatment, removal of the fractured instrument, perforation repair, surgical endodontics, root-end procedures and many more. It enhances lighting and visibility, precision in refining the access cavity and in locating and negotiating all the root canals. CBCT also plays an important role when considering the complex anatomy of tooth. Conventional radiographic techniques, at best, can only detect up to 55% of these configurations. Studies have found that evaluating different two dimensional film modalities were rarely able to detect more than a 50% presence of MB2 canals. So whenever suspecting for something unusual CBCT should be opted. A three rooted maxillary premolar requires an access cavity modification into a “Triangular” shape mesio-distally extending the buccal aspect of the usual outline form. This modification allows good access to each of the two buccal canals which will be compromised if conventional oval access preparation is made.

The management of the furcation involvement presents a unique clinical problem. Reasons for compromised results in furcation areas include the lack of proper access for instrumentation as well as for proper maintenance care due to the complex furcation anatomy and consequently a persistence of pathogenic micro flora. The early work concentrated more on resective procedures intended to eliminate the pocket by furcationplasty and root resection. The most favorable outcome of any furcation therapy would be the regeneration of the lost attachment apparatus, which would result in the closure of the furcation. The various regenerative approaches utilized in the management of class II furcation involvements include root surface bio-modification, coronally positioned flaps, the use of various bone replacement grafts, and Guided tissue regeneration procedures.

Successful treatment of grade II furcation defects includes regenerative therapy; and biological principle of guided tissue regeneration is routinely applied in such cases. However, when it occurs due to endodontic reasons, it becomes necessary to manage the endodontic challenge first. The basic goal of root canal treatment is thorough mechanical and chemical cleansing of the entire pulp cavity and its complete obturation with an inert filling material. Tissue-engineering – based treatment is an attempt to achieve regeneration in cases with furcation involvement mostly grade II. Kanakamedala et al, reported treatment for furcation defect with PRF and bone graft. A regenerative periodontal flap surgery is performed to eliminate the deep periodontal pocket, access the bone defect and the furcation involvement. The osseous bone graft has shown to have a positive effect on bone formation.

Conclusion

The maxillary first premolars are candidate for multiple morphological complexities and can create pathfinder routes from the pulp to periodontium. This particular case highlights the successful endo-perio management of the three rooted maxillary first premolar with three distinct root canals complicated with a grade II furcation involvement. Critical assessments using clinical and radiographic skills, along with regenerative management of the bone defect has attributed to the satisfactory management of the tooth.

The use of current diagnostic aids like CBCT and clinical use of DOM is very important for the management of such a complicated cases and hence recommended.

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References:
7. Amber Ather, M. Jyoti Varghese, M. Vidyasaraswathi, VasydevBallal, Shashirashmi Acharya. Interdisciplinary management of 2 rooted mandibular 1st premolar with furcation involvement:
Endodontology, December 2015;27(2):192-197

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A 2-year follow-up. Journal of Inter disciplinary dentistry 2013; 3:


