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Endodontic Management of Three Rooted Maxillary First Premolar with the Aid of CBCT & Dental Operating Microscope: A Case Report

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Abstract

Aim: This case report describes how to diagnose and to manage clinically in three rooted upper first premolar with the aid of CBCT and magnification (DOM).

Summary: According to the previous studies, the prevalence of morphological variations in root canal system is known fact. Upper premolars highly vary in the morphology of the root canal, but the incidence of three roots and canals are very rare. In this case, the report discusses to diagnose and manage endodontically of an upper first premolar with three canals with their three distinct roots, drawing particular attention to radiographic interpretation, CBCT, Dental Operating Microscope, and access modification.

Keywords

Anatomical variations; CBCT; Endodontic treatment; Magnification; Three rooted maxillary first premolars

Introduction

Incidence [1] of three canals in maxillary first premolars found to be 5-6% [2] and second premolars to be 1%. According to the study done by Vertucci and Gegauff, 5% of 400 maxillary first premolar had three canals; 0.5% showed three canals in a single root, 0.5% showed two canals in one root and single canal in another root, 4% showed single canal in three distinct roots. A study done by Carns and Skid more [2] showed 6 out of 100 maxillary first premolar had three canals in three separate roots. To achieve successful [3] root canal treatment, thorough knowledge of root canal morphology, high quality of preoperative radiograph [4], tactile examination of pulpal floor and pulpal chamber and disinfection in entire root canal system is required [5]. Major causes attributed to the failure of endodontic treatment are missed canals, improper instrumentation, and Obturation [1]. Previous studies have been reported on the various configuration of maxillary first and second premolars [6-9]. Because of the similar morphology of maxillary premolars with three root canals to that of adjacent molars, maxillary premolars are called as ''small molars'' or '' ridiculous'' [10,11]. ''Sieraski'' et al. [12] study found that radiographically whenever the mesiodistal width of [8] mid root image is equal to or greater than mesiodistal widths of the crown, tooth most likely had three roots [2]. Preoperative radiograph gives a two-dimensional view of the three-dimensional object, but accurate interpretation can reveal fine morphology suggesting the existence of extra roots or canals. Whenever there is sudden disappearance of radiolucency in the pulp cavity will suggest extra canal [13]. Thus the proper interpretation of preoperative radiograph [14-16] and use of Dental Operative Microscope (DOM) and Cone Beam Computer Tomogram (CBCT) as an additional diagnostic tool to determine the anatomical variations [7,8] will lead to great success.

Case

A 41 year old male patient with non-contributory medical history was referred to the department of Conservative dentistry for root canal treatment of maxillary right first premolar [17]. A Chief complaint of the patient was a pain [8] in relation to the upper right posterior region from the past eight weeks. Nature of the pain was dull and intermittent. Intraoral clinical examination reveals deep caries with no evidence of swelling and sinus tract. A Tooth was mild tender on vertical percussion. Pulp sensibility test with cold (Ethyl chloride spray) and electric pulp tester (PARKELL INC, EDGEWOOD, NEW YORK) revealed no response from the maxillary first premolar. The Pre-operative Periapical radiograph revealed a large proximal caries involving the pulp and widening of periodontal ligament space with no evidence of Periapical pathology was seen in relation to tooth 14 (Figure 1). Based on clinical and radiographic interpretation, it was diagnosed as necrotic pulp with symptomatic apical periodontitis [7]. Greater mesiodistal diameter in the middle third of the first premolar externally and the sudden disappearance of radiolucency in the pulp cavity suggested extra roots and canals [2]. Treatment plan of an involved tooth was decided to perform endodontic treatment, prior to treatment, subjected to undergo Cone Beam Computed Tomography (CBCT) to confirm root canal anatomy. The Procedure was [15] briefed to the patient and

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written consent was taken. The Patient was subjected to CBCT (Kodak Dental Systems, Care stream Health, Rochester, NY, USA) and confirmed three separate roots in first premolar (MB, DB&P) (Figure 2). The tooth was anesthetized with LOX 2% Adrenaline (1:200000). Following isolation with a rubber dam, an endodontic access opening was made under magnification of a dental operating microscope (G6, Global Surgical Corp, 8.0X, St. Louis, MO, and U.S.A). Access cavity was prepared using an Endo-Accessbur (DENTSPLY Maillefer, Switzerland) and [1] modification in access cavity by giving a cut at a Bucco-proximal angle from the beginning of buccal canals to the cavo surface angle resulting in a 'T' shaped outline cavity. All the three, Mesiobuccal (MB),

Figure 1: Preoperative intraoral peri-apical radiograph

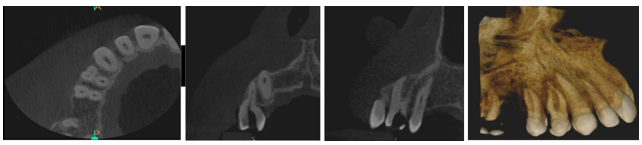

Figure 2: CBCT Images

distobuccal (DB) and the palatal (P) canals were explored with DG-16 endodontic explorer (Figure 3) [4]. Working length was determined using apex locators (Root ZX, J. Morita, and USA) and radiographically confirmed (Figure 4). Canals ware [13] cleaned and shaped using crown down technique with rotary instruments (ProTaper, DENTSPLY Maillefer, Ballaigues, Switzerland), followed by disinfecting canals with 5.25% sodium hypochlorite [7] irrigant solution. All the root canals were enlarged to size F3 and final irrigation was done with 17% EDTA solution. Master F3 cone was selected and check in master cone radiograph was taken (Figure 5). Obturation was done with cone and sealer (AH Plus, DENTSPLY, Ballaigues, Switzerland) and access cavity was restored with MD-Temp (Temporary Restorative, META BIOMED, Korea). Post-Obturation radiograph was taken (Figure 6). The Patient recalled after one weak for permanent access cavity filling with adhesive composite restoration (Clearlmajesty™ posterior, Kuraray America, Inc. NY, USA). Follow up radiograph taken after three months (Figure 7) and tooth 14 found to be asymptomatic.

Discussion

In literature, possible anatomic variations in maxillary premolars are well documented. For detection of additional root canals, the prerequisite is high-quality preoperative radiographs and their careful interpretation [14-16]. Walton's study [1,17] advocated the use of two diagnostic radiographs at different angulation. Abrupt loss of radiolucency in pulp space or sudden narrowing in radiograph suggests splitting of the canal into two separate canals or may merge before exiting at apex [18]. If a canal orifice is situated eccentrically, at least one

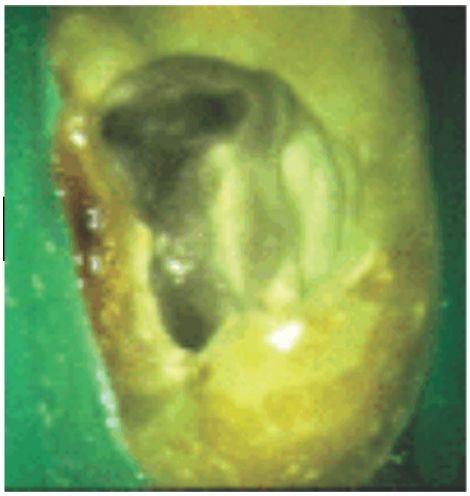

Figure 3: Magnification of canal orifices from Dental Operating Microscope (DOM, Global)

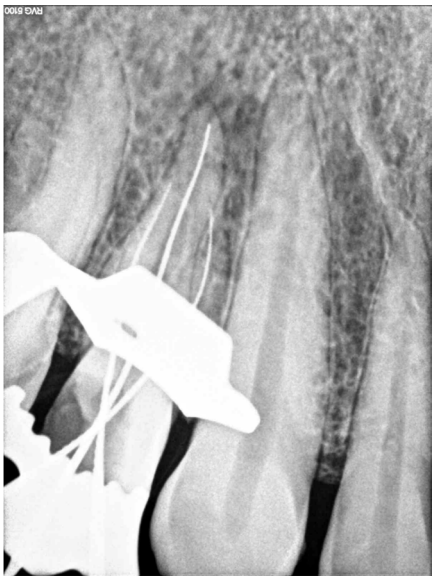

Figure 4: Working length radiograph

Figure 5: Check in master cone radiograph

Figure 6: Post Obturation radiograph

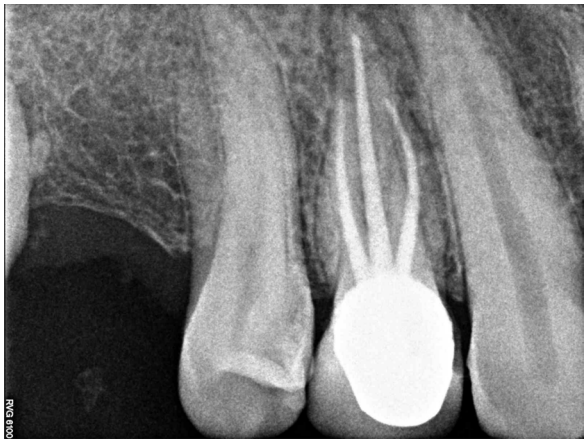

Figure 7: Follow up radiograph

more canal is present and searched for in opposite direction. If the pulp chamber does not appear to be aligned in its expected Bucco-palatal relationship, a third canal can be suspected clinically. In addition, if it appears to deviate from the normal configuration of the pulp chamber and seems to be either too large in a mesiodistal plane or triangular shape, an additional root canal may be suspected [19]. Variations in the morphology of pulp cavity make the endodontic treatment uniquely challenging. The proximity of the buccal orifices is close to each other in three-rooted maxillary premolars are hard to locate. Balleri et al. [20] suggested a modified access cavity outline, shaped by a cut at the Bucco-proximal angle from the entrance of the buccal canals to the cavosurface angle resulting in 'T' shaped access outline. Radiographic image [6] produces two dimensional (2D) representation of three dimensional (3D) objects. CBCT [6] in endodontics plays an important role that demonstrates anatomic feature in 3D that panoramic and cephalometric images can't produce. Hence this case highlights the utilization and importance of magnification (DOM) along with CBCT to diagnose and manage [11] three-rooted maxillary first premolar efficiently.

Conclusion

Thorough knowledge about root canal configuration and its variations will aid in achieving successful root canal treatment. Complex root canal anatomy demands modification in the access cavity. When encountered with unusual anatomy, additional diagnostic aid like magnification (DOM/LOOP) in endodontics and CBCT utilization to locate all orifices and manage optimally.

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