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Endodontic management of mandibular second molar with Vertucci II canal configuration using Cone Beam Computed Tomography

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Abstract

Permanent mandibular second molars usually show two roots, one mesial and the other distal root with four root canals (two mesial and two distal canals). Variation in root number and canal morphology rarely occur in these teeth. Cone Beam Computed Tomography is a new advent in the diagnostic field which provides three dimensional clear picture of the root/canal. The present article describes the endodontic management of permanent mandibular left second molar with Vertucci II canal configuration using cone beam computed tomography.

Keywords: Cone beam computed tomography, Endodontic Treatment, Mandibular Second Molar, Vertucci Classification

Introduction

Permanent mandibular second molars usually display the normal anatomy of two roots, one mesial and the other distal with four root canals (two mesial and two distal) [1,2]. However, the morphology of root canal system in these teeth can vary according to the races, age and gender of the population studied [3-6]. For the success of endodontic treatment, thorough knowledge of canal anatomy, number of roots and curvature of root canal is important to locate, negotiate and finally for management of canals. The conventional diagnostic method using periapical radiographs provides only two dimensional pictures of the roots and canals [7]. So chances of leaving the undiagnosed canals are high which finally ends up in the treatment failure.

Cone beam computed tomography (CBCT) imaging is a novel diagnostic modality which attracted the field of Dentistry in various aspects, as it provides a 3 dimensional view of the entire canal system [3-6]. The aim of this paper is to describe the endodontic management of permanent mandibular second molar with Vertucci II canal type which was diagnosed using CBCT scan.

Case Report

A 14-year-old female patient reported to the Department of Pedodontics and Preventive Dentistry with a chief complaint of pain in lower left back region of jaw since 1 week. She gave a history of nocturnal pain which was moderate, continuous, non-radiating and increases while biting food. On clinical examination, there was deep occlusal caries in relation to permanent mandibular left second molar (37 – FDI tooth notation), and the tooth was sensitive on percussion. The tooth showed positive response to pulp test (heat test). Provisional diagnosis of acute apical periodontitis was made considering all the above factors. To confirm the diagnosis, an intraoral periapical radiograph was taken with respect to 37, which showed two radiolucent canals which were in close approximation with each other near apex, with periapical radiolucency (Figure 1, A); finally based on the clinical and radiographic findings the case was diagnosed as chronic periapical abscess.

Endodontic treatment of 37 followed by prosthetic rehabilitation was planned. In the following appointment an access cavity preparation was done. 3 canals were negotiated, 2 mesially which were very close to each other and 1 distally. The mesial root as wells as canals were severely curved. Working length was determined using periapical radiograph, with different angulation which suggested that the canals were

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fused at the apex (Figure 1, B). To confirm the number of canals and to know whether the canals are fused at apex or not, CBCT imaging was made with respect to 37. On serial axial sections of CBCT imaging it was found that the two mesial canals were very close to each other and hence looked like one canal. The distal root had one straight canal. As the two canals progressed apically the two canals merged each other resulting in one canal (2-1 Vertucci canal type) [8] (Figure 2). In panoramic view of the CBCT it was noticed that the mesial canal had severe curvature ('S' shape based on Dobo-Nagy et al. classification [9]) towards buccal side fused with the distal root (Figure 3).

After location and confirmation of canal's configuration and pulp debridement, biomechanical preparation of the canals was done using hand protaper files along with hydrogen peroxide as an intermittent irrigant. Once the canals were prepared triple mix antibiotic dressing was given for 1 month. After 1 month patient was asymptomatic and canals were obturated to the working length using single cone obturation technique (Figure 1, C & D).

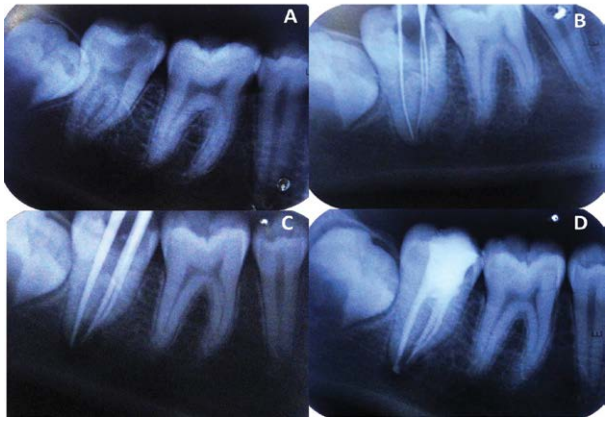

Figure 1: [A] Intraoral Peri-apical, pre-operative diagnostic radiograph showing permanent mandibular left second molar with complex root anatomy. [B] Working length determination [C] Master cone selection [D] Post-obturation radiograph

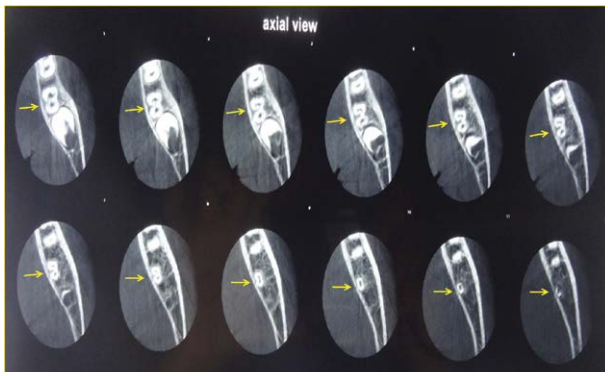

Figure 2: Serial axial sections of CBCT imaging of the permanent mandibular left second molar. Initially we can see the two canals. As the canals progress apically merging of two canals resulting in one canal can be seen (arrows).

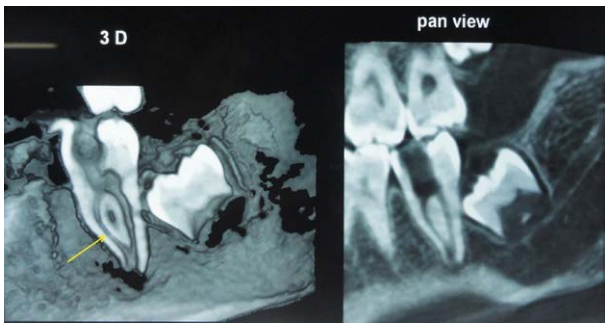

Figure 3: CBCT image of the same tooth (37) showing Vertucci type II canal configuration (2-1) and also 'S' shape bend in the mesial canal (arrow).

Discussion

The type and canal morphology in mandibular molars presents clinical complications during endodontic therapy. Vertucci in 1984 [8] categorized the root canal configuration of human permanent teeth into eight types as follows: Type 1 – a single canal extends from the pulp chamber to the apex (1); Type II – two separate canals leave the pulp chamber and join short of the apex to form one canal (2-1), Type III – one canal leaves the pulp chamber divides into two within the root and then merges to exist as one canal (1-2-1), Type IV – two separate and distinct canals extend from the pulp chamber to the apex (2), Type V - one canal leaves the pulp chamber and divides short of the apex into two separate and distinct canals with separate apical foramina (1-2), Type VI – two separate canals leave the pulp chamber, merge within the body of the root and re-divide short of the apex to exit as two distinct canals (2-1-2), Type VII – one canal leaves the pulp chamber, divides and then rejoins within the body of the root and finally re-divides into two distinct canals short of the apex (1-2-1-2) and Type VIII – three separate canals extend from the pulp chamber to the apex (3). Based on this classification, in the present case the canal shape was categorized as Type II shape (2-1) as the two separate canals originated from pulp chamber and merged at the apex.

Ahmad et al. [5] found 8% of permanent mandibular second molars with fused two roots in their study using clearing technique in Sudanese population. They have also claimed that most of the distal roots of second molars (69%) had one canal. Most mesial roots (83%) had two canals, of which type IV (63%) and type II (18%) canal configurations were most common. Whereas Mirzaie et al. [4] noticed only 30.3% of type II canal shape in Hamadani population using CBCT diagnostic tool. Recently contrary to this finding Nur et al. [3] found maximum of type IV canal variation in Turkish population following CBCT evaluation.

The root canal curvature is classified by Dobo-Nagy et al in 1995 [9] as I (straight), J (apical curve), C (entirely curved) and S (multi-curved) shape based on the curvatures seen in the canal. According to this classification, in our case the mesial canal of the molar showed 'S' shape curve merging with the distal root near the apex.

Use of CBCT has several advantages compared to conventional radiography. These include 3-dimensional image reconstruction, removal of superimposed structures, sub-millimeter resolution and showing normal anatomy and morphology of the root canal system without additional exposure. In addition, it gives images of higher resolution than those obtained by conventional periapical radiographs. It provides much more detail about the root canal morphology during endodontic procedure, and is more sensitive in detection of supplemental canals compared to radiographic images [3-6,10].

In the case presented here, the permanent mandibular second molar exhibited complicated root anatomy in CBCT imaging which was not evident on periapical radiographs. But with CBCT it was found that both distal root and its canal were straight. The mesial root was severely curved from the middle to root apex fused with the distal root. As a result it revealed Vertucci II canal configuration. Serial axial sections of CBCT also showed that at the cervical part of the root two canal orifices (one mesial and other distal) were found. As canals progressed apically the two canals merged each other near the apex resulting in one canal. From this case it is understood that occurrence of complex root canal anatomy are possible during endodontic procedure and correct diagnosis of such variations using advanced diagnostic technique like CBCT is highly useful for the valuable treatment of the tooth.

Conclusion

Successful endodontic therapy involves complete pulp removal followed by three dimensional seal of the endodontic space. CBCT is a valuable diagnostic aid in studying the root canal morphology of human teeth in order to enhance the success rate of endodontic therapy.

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