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Maxillary Second Molar with Mesiobuccal Second Canal Diagnosed with Cone-Beam Computed Tomography Scanning: A Case Report

Karunamoorthy JR[1], Velkrishna K[2], Meshack RA[3], Tan HL[4], Yong CJ[5]

[1] *Senior Lecturer, Department of Conservative Dentistry and Endodontics, Penang International Dental College, Pulau Penang, Malaysia.*

[2] *Reader, Department of Conservative Dentistry and Endodontics, Vinayaka Missions Sankarachariyar Dental College, Salem, India.*

[3] *Professor, Department of Conservative Dentistry and Endodontics, Penang International Dental College, Pulau Penang, Malaysia.*

[4] *Final Year BDS Student, Penang International Dental College, Pulau Penang, Malaysia.*

[5] *Final Year BDS Student, Penang International Dental College, Pulau Penang, Malaysia.*

ABSTRACT

To present an endodontically managed maxillary second molar with a second mesiobuccal canal diagnosed with a cone beam computed tomography (CBCT) scanning. This report also highlights the role of CBCT as an objective method to confirm the three-dimensional (3D) anatomy of teeth which will aid in identifying presence of additional root canals. The CBCT proved to be relevant in providing important information on the root canal system for the planning of endodontic treatment in cases of persistent infection due to untreated root canals.

Key Words: Maxillary second molar, MB2, Cone-beam computed tomography

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INTRODUCTION

Knowledge of the variation of the root canal morphology, especially in multi-rooted teeth, is an extremely important point for diagnosis, successful planning and performing endodontic therapy.[1] The Maxillary molars, especially the second molars have a more complicated root canal system. James Walcott examined 2038 maxillary 2nd molars and found 712 (35%) teeth to have second mesiobuccal canal.[2] A thorough knowledge of the root canal anatomy is mandatory because if a canal is missed and goes untreated it will lead to endodontic failure.[3]

Conventional intra-oral periapical radiographs are an important diagnostic tool in endodontics for assessing the number of canals and canal configuration in a tooth. However, it is not completely reliable due to the superimposition of the teeth and surrounding structures which results in 2D view of a 3D object.[4] Recently, newer diagnostic methods such as CBCT overcame the disadvantages of radiographs by providing a 3D image, thus emerging as a valuable tool for the evaluation of pulp space morphology.[5]

CBCT scans were designed for hard tissue imaging in the maxillofacial region. Recently, their use in endodontics has been successful because they are non-invasive and the results are accurate.[6] For endodontic applications, limited volume CBCT is preferred over large-volume CBCT. Limited volume CBCT scanners can capture small volumes of data. This data can accommodate a 40x40 mm volume of data which is synonymous to a periapical radiograph. Clinicians should remember that when ordering the CBCT they are responsible for interpretation of the entire image volume. Therefore, the clinician can be liable for a missed diagnosis, even if it is outside his/her area of practice.[7]

Here we used Pax-Flex 3D Dental Digital Imaging System (Vatech America, United States) which provides a grey scale image of 14 bits and with a voxel size of 0.125 mm and image slice thickness of 1 mm with a 17 seconds exposure. The

paper highlights the successful management of an attempted root canal in a case of second mesiobuccal canal (MB2) in the right maxillary second molar with the help of a CBCT scan.

CASE REPORT

A 40-year-old female patient presented to our clinic with a chief complaint of pain in the right maxillary second molar. Patient gives a history of root canal treatment initiated on right maxillary second molar 5 weeks back, which was still not completed but the patient has been in agony ever since root canal treatment was started.

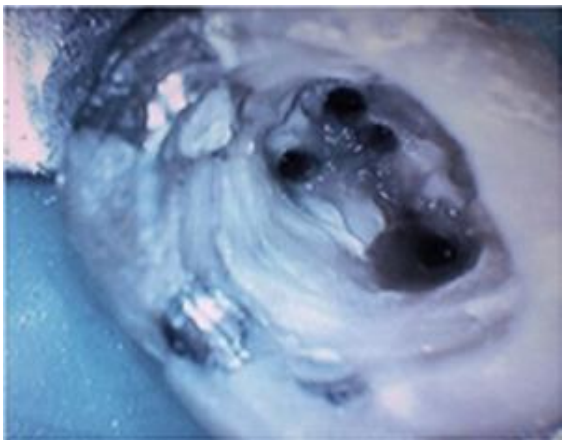

Figure 1. Clinical view of the access cavity showing the orifices of the four canals.

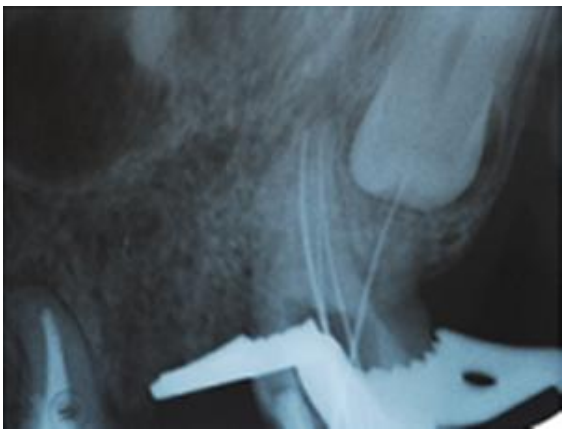

Figure 2. Mesial angulation working length radiograph of tooth.

Clinical examination revealed normal intraoral and extra oral findings, and the tooth showed a large temporary restoration. The tooth was very sensitive to percussion, and had pain on biting. Radiographic evaluation of the maxillary right second molar showed an initiated pulp space therapy. The diagnosis was a failed root canal therapy, and the probable etiological factor for failure could be related to a crack, incomplete cleaning and shaping, coronal leakage, or an additional canal not located.

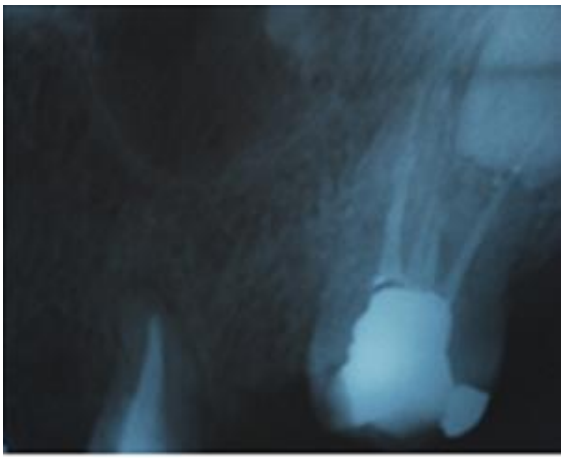

Figure 3. Post obturation radiograph of tooth.

A standard endodontic procedure was initiated after administering local anesthesia with 2% lignocaine containing 1:100,000 epinephrine. The tooth was isolated using a rubber dam and the canals were explored using a DG16 (Hu-Friedy, Chicago, IL) endodontic explorer. On visual examination of the access cavity there was no evidence of an extra canal since the pulpal floor was troughed making it difficult to search.

Figure 4. Recall radiograph of tooth after 6 months.

To ascertain the 3D morphology of this tooth, dental imaging with the help of CBCT was therefore planned. Informed consent was obtained from the patient for carrying out the procedure.

The machine operated at 90KV and 5.3mA, with a 17sec exposure time. Saggital, coronal and axial 2D section images were displayed on a computer screen and then inspected by two endodontists, using One Volume Viewer software.

The CBCT images of the maxillary right second molar clearly revealed presence of MB2 canal (Fig.5-6). The canal was traced and negotiated using small size instrument 6, 8 and10 K-files (MANI.INC. Tochigi, Japan) sequentially. The working length was established and the orifice enlarged with Gates Glidden drills (MANI.INC, Japan) and all the four canals were cleaned and shaped till the apical constriction using a protaper rotary system (Dentsply Maillefer, Ballaigues, Switzerland) and obturated three dimensionally with Protaper GP points (Dentsply Maillefer, Ballaigues, Switzerland) and AH plus (Maillefer, Dentsply, Konstanz,Germany) root canal sealers (Fig.1-3).

After a week the patient was recalled and the patient was asymptomatic which can be attributed to the location and obturation of the additional MB2 canal. The tooth was restored with a posterior composite resin core (P60; 3M Dental Products, St Paul, MN). The patient was advised a full-coverage restoration and was asymptomatic during the follow-up period of 6 months (Fig.6).

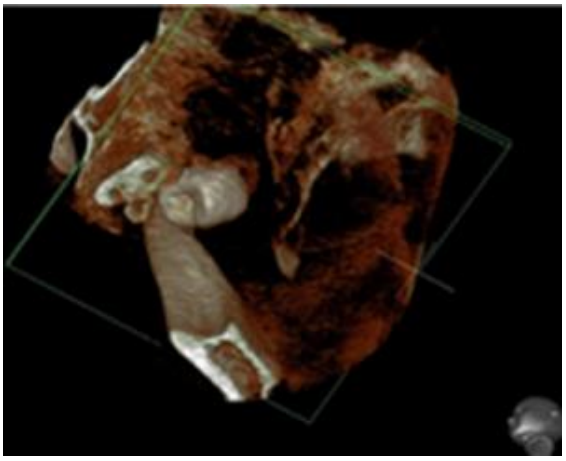

Figure 5. 3D image clearly showing the four canals.

DISCUSSION

Variation in pulp space anatomy is not uncommon. Emel Olga et al showed the prevalence of mesiobuccal second canal from first to third molars to be 70.2%, 31.7% and 14.3% respectively.[8] In Another study by Msed Khalid et al a total number of 162 maxillary second molars 32 (19.7%) met the criterion of having two canals in the mesiobuccal root.[9] Several methods are employed to trace additional canals during root canal therapy. Apart from dentine map, bleeding spots, champagne test, loupes, surgical microscope, newer diagnostic aids like spiral-CT, CBCT proved to be a valuable tool for locating additional canals.[10,11,12] Mastherne et al in his study used CBCT scans to identify the internal root morphology of multi-rooted teeth and compared them to the digital radiographic images. From his study, he concluded that CBCT images always resulted in higher percentage of canal identification than digital images.[13]

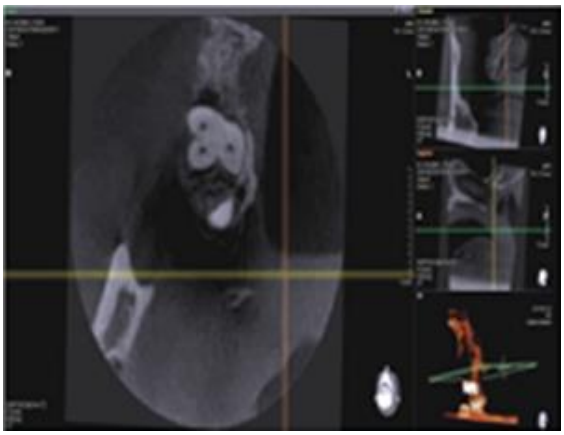

Figure 6. Axial CBCT images for maxillary right second molar confirmed the presence of an additional canal.

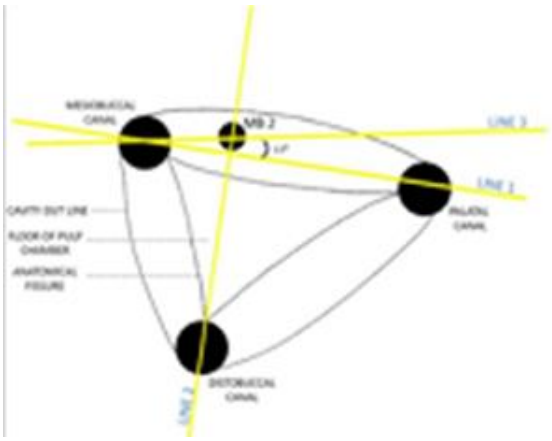

Figure 7. Geomatric aid showing the position of MB2.

The CBCT scans have many advantages than the spiral CT scans in effective dose reduction; rapid scan time; and x-ray beam limitation which is achieved by reducing the area of irradiation by

collimating the primary x-ray beam to the area of interest.[10,12] The rapid scan time (7-14 seconds) is because the total 3D volume of data is obtained in a single rotation by a cone shaped beam unlike the spiral CT that uses a fan shaped beam.

The effective dose (E) is 100 to 300 µSv for maxilla and 200-500 µSv for the mandible when a patient is exposed to Conventional CT, whereas the radiation is 34 to 102 µSv for both maxilla and mandible when using a CBCT.[14,15] If additional personal protection (lead apron with thyroid collar) and patient procedure modification (tilting the chin) is done, dosage can further be reduced by up to 40%.[16]

Although CBCT technology has great value, it also has its limitations. The radiation dose of CBCT may be less than the conventional CT's, but its radiation dose is still higher than digital and conventional intraoral radiographs.[16] In modern day practice, CBCT scans are limited to major metropolitan areas and the costs for CBCT imaging are relatively expensive. Limitations also include medico-legal issues to obtain CBCT data.[11]

Apart from the data provided by CBCT in our case, we used the geometric aid suggested by Beer and Baumann[17] to locate the MB2 (Fig 7). In this method, line 1 is drawn from the mesiobuccal canal to the palatal canal and line 2 was drawn perpendicular to line 1 at a point 1/3rd to the inter-canal distance from the palatal canal such that this line passes over the distobuccal canal. A 4th canal lies somewhere along line 3, which deviates approximately 10º from line 1 in anticlockwise direction.

CONCLUSION

Emphasis should be given for tracing extra canals using various methods while treating maxillary molars. This paper highlights the use of CBCT as an objective analytic tool to ascertain the internal dental anatomy and the advantage of using the geometric aid to locate the MB2 canal in the absence of a dental operating microscope.

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Corresponding Author:
Dr. Jeyaval Rajan Karunamoorthy
Senior Lecturer
Level 18-21, NB Tower
5050, Jalan Bagan Luar
12000, Butterworth, Malaysia
Tel: 604-3325050
Email: jeyavelrajn@yahoo.co.in