Case Report

Software-guided predictable endodontic management of three-rooted lower right second premolar

ABSTRACT

It is essential in endodontics to understand the morphological anatomy of the roots and root canal systems of the teeth to increase the success rate of root canal therapy. Advanced diagnostic imaging modalities like cone-beam computed tomography (CBCT) and the assistive software like three-dimensional (3D) Endo Software (by Dentsply Sirona) are very helpful aids in understanding the anatomy of the teeth, especially the complicated premolars. Most commonly mandibular first and second premolars have a single root and root canal system. However, multiple roots and canals have also been reported in few cases which are considered as a challenging task for an endodontist. The present case report discusses the complete endodontic management of a three-rooted mandibular second premolar using CBCT imaging and assistive guidance by 3D Endo Software (by Dentsply Sirona).

Keywords: Cone beam, digital endodontics, surgical microscope, three-dimensional endo

INTRODUCTION

A successful endodontic therapy requires a predictable visualization and thorough knowledge of the root canal anatomy and its variations.[1] Conventional two-dimensional (2D) radiographs continue to be the most popular method of imaging today. However, the diagnostic potential of periapical radiographs is limited. Information may be difficult to interpret, especially when the anatomy and background pattern, is complex like three-rooted mandibular premolars.[2]

Mandibular second premolar generally has a single root and root canal in the majority of the population.[2] The second premolars have only one root canal at the apex in 97.5% of the teeth and two canals in only 2.5%.[3] Over the years, studies have reported the root canal morphology of mandibular premolars with a high incidence of these teeth having more than one canal. According to Zillich and Dowson, the incidence of three roots and canals is 0.4%.[3]

Recently, a new software for analyzing endodontic parameters on cone-beam computed tomography (CBCT) images, the 3D Endo TM (Dentsply Sirona, Wels bei Salzburg, Austria) has been developed to allow a more interactive and user-friendly interface for the identification and visualization of root canals. This novel software can automatically identify the reference points on occlusal anatomy, canal trajectory, measure root canal length, and also use a color code for easier visualization of anatomical details such as confluences and curvatures in 3D in challenging root canal anatomies.

This report presents a case of successful nonsurgical endodontic management of mandibular second premolar with three separate roots using CBCT and 3D Endo Software.

Purnil B. Shah[1], Nili Shah[2], Pratik Kariya[3]

[1]Senior Lecturer, Department of Conservative Dentistry and Endodontics, [3]Reader, Department of Paediatric and Preventive Dentistry, K M Shah Dental College and Hospital, Sumandeep Vidyapeeth, Piparia, Vadodara, [2]Periodontist, PhD Scholar, Gujarat University, Ahmedabad, Gujarat, India

Address for correspondence: Dr. Purnil B. Shah,
4, A Manav Mandir Society, Waghodia Road, Vadodara, Gujarat, India.
E-mail: purnil16b@gmail.com

Access this article online	
Website: www.ijpcdr.org	Quick Response Code
DOI: 10.4103/INPC.INPC_9_19	

How to cite this article: Shah PB, Shah N, Kariya P. Software-guided predictable endodontic management of three-rooted lower right second premolar. Int J Prev Clin Dent Res 2018;5:81-3.

CASE REPORT

A 22-year-old male patient reported to the Department of Conservative Dentistry and Endodontics, KM Shah Dental College and Hospital, Sumandeep Vidyapeeth with a chief complaint of pain in the lower left back tooth region for 3 months. The patient gave a history of trauma 6 months ago and fractured tooth in the same region. On clinical examination, there was a gingival inflammation with gingival overgrowth in relation to tooth numbers 45. The tooth was tender on vertical percussion. Electric pulp testing and thermal testing of the teeth indicated nonvitality of 45. Confirmatory diagnosis of chronic apical periodontitis in relation to 45 is established, and endodontic therapy was planned. An intraoral periapical radiograph showed bifurcated 44.45 [Figure 1a]. Since the anatomy was atypical for the premolar tooth the patient's consent was obtained to proceed for CBCT evaluation and further treatment plan. CBCT with a 3D reconstruction confirmed a three-rooted 35 [Figure 1b].

For further analysis, the 3D EndoTM (Dentsply Sirona, Wels bei Salzburg, Austria) software was utilized. The software was used to crop the area corresponding to the tooth lower left second premolar in the axial and parasagittal planes. Once the tooth was selected, the three canals were identified on the axial images, i.e., mesiobuccal (MB), distobuccal (DB), and lingual, and their orifices on the pulp chamber floor were identified along with the corresponding foramina. This allowed the software to automatically reveal the pathway of each canal, which could be adjusted in 3D if needed, to properly follow the curvature and then viewed in frontal and mesial views [Figure 2a and b].

The 3D Endo Software allowed easy, quick, and reliable reproductions of canal trajectories, in both clinical and proximal views and also provided a tentative working length and path of endodontic files in all three canals in a PDF report.

The preoperative preparation was done by the consultant periodontist who performed microscope-enhanced crown lengthening surgery (2.5 × Magnification, Labomed, India) on the second premolar to get supragingival margins for the final restoration. The root canal treatment was planned after 1 week once the complete periodontal healing was assured.

After getting the report and preoperative preparation of the case, the area was anesthetized using 2% lignocaine with 1:80,000 adrenaline (Lignox) and isolated with a rubber dam. An access cavity was prepared under Labomed Microscope ×2.5, with a modification that it had a cut at the buccoproximal angle from the entrance of the buccal canals to the cavosurface angle, and hence it resulted in a T-shaped outline [Figure 3]. All the three canals were negotiated with a size 10 K-file. Working length was determined using an apex locator (Root-ZX) in conjunction with the prescribed working length using 3D Endo Software. The Working length at the "0" reading on apex locator almost accurately correlated with the length taken by the 3D Endo software. After glide path preparation, Hyflex EDM (Coltene) rotary files were used in a crown-down manner to complete the biomechanical preparation. Abundant irrigation with 3% sodium hypochlorite solution was done in between the rotary files along with repeated recapitulation using #10 K file. Apical preparations were finished at 25/04 for MB and DB canals and 30/04 for the lingual canal. Calcium hydroxide as intracanal medicament was kept for 1 week. Before obturation, irrigation with 5 mL of 17% ethylenediaminetetraacetic acid was done for each canal. Obturation was performed with gutta-percha

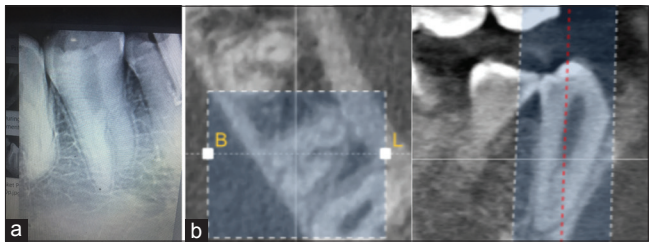

Figure 1: (a) Preoperative X-ray of lower right second premolar. (b) Cone-beam computed tomography of 45 confirmed three roots and three root canals

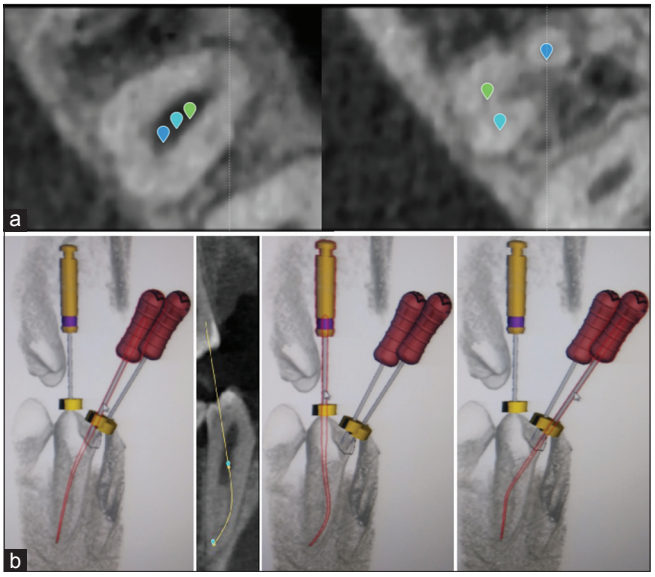

Figure 2: (a) Three-dimensional Endo Software-guided planning for lower second premolar orifice and apical foramen identification. (b) Software-guided canal orientation for mesiobuccal, distobuccal, and lingual canals with working length

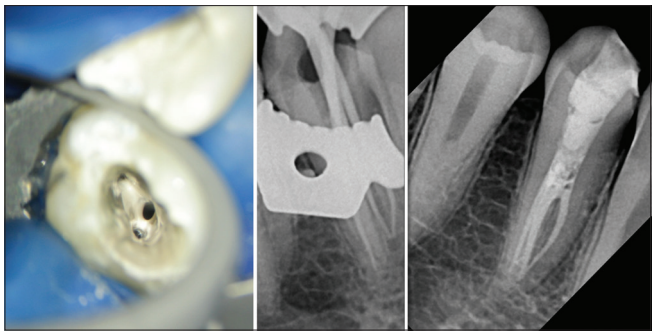

Figure 3: Clinical steps in the execution of complete root canal treatment with final postoperative X-ray

and resin sealer (AH Plus, Dentsply) using cold lateral condensation. The coronal access was restored with resin composite (3M ESPE) [Figure 3].

DISCUSSION

Successful and predictable endodontic treatment requires the knowledge of root canal anatomy and careful radiographic evaluation to determine the number of roots and root canals. The diagnosis and management of extra roots or root canals in mandibular premolars pose an endodontic challenge. Failing to locate and obturating a root canal is the major cause of failure in endodontic therapy. Hoen and Pink found 42% incidence of missed roots or canals in the teeth that needed retreatment.[4] According to Cleghorn, the incidence of three-rooted mandibular first premolars is 0.2%.[2]

The high-spatial resolution of 4 × 4 field of view CBCT (J Morita, Japan) offers the possibility of exploring the complete root canal anatomy in 3D in a detailed, noninvasive way with least radiation exposure.[5] Although preoperative parallel radiographs, as well as mesial or distal angled radiographs, can help to determine the number of roots, the inherent disadvantages of two-dimensional imaging cannot be overcome. Thus, a CBCT in complex anatomy enables the operator not only to visualize but also to plan stepwise treatment protocol for the complex anatomy cases.[5]

Application of information acquired from CBCT is also challenging. Visualizing a digital image and correlating it with clinical scenario are a task in itself. 3D Endo Software is one such tool to bridge the gap between understanding a CBCT digital image and its application clinically. The software allows annotation of the coronal reference point and apical constriction. It also has a provision to mark the canal at multiple points throughout its length. Thus, an operator gets to understand the working length in true sense along with orientation of the file in relation to the tooth.[6] This software avails real-time clinical information to the operator and helps in smooth preplanning of the procedure with considerable accuracy.

In the above case, the software enabled us to educate the patient about the abnormal anatomy and helped in understanding the file insertion path in all the canals as the projection of the canal became easy.

Apex locator was also used as the success rate of apex locator cannot be underestimated and the software still needs some validation and accuracy determination. This above case suggested that it could be a very valuable tool in the field of endodontics.[6]

CONCLUSION

This novel 3D Endo Software-guided endodontics can complement the advantages of CBCT scan in terms of root canal treatment planning and treatment execution in a clinical situation. Further clinical studies are required to authenticate the methodology and competency for the same.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Vertucci FJ. Root canal anatomy of the human permanent teeth. Oral Surg Oral Med Oral Pathol 1984;58:589-99.
2. Cleghorn BM, Christie WH, Dong CC. The root and root canal morphology of the human mandibular second premolar: A literature review. J Endod 2007;33:1031-7.
3. Zillich R, Dowson J. Root canal morphology of mandibular first and second premolars. Oral Surg Oral Med Oral Pathol 1973;36:738-44.
4. Hoen MM, Pink FE. Contemporary endodontic retreatments: An analysis based on clinical treatment findings. J Endod 2002;28:834-6.
5. Michetti J, Maret D, Mallet JP, Diemer F. Validation of cone beam computed tomography as a tool to explore root canal anatomy. J Endod 2010;36:1187-90.
6. Tchorz JP, Wrbas KT, Von See C, Vach K, Patzelt SBM. Accuracy of software-based three-dimensional root canal length measurements using cone-beam computed tomography. EUR Endod J 2019;4:28-32.