International Journal of Current Research and Review
DOI: http://dx.doi.org/10.31782/IJCRR.2022.141006

Review Article

IJCRR
Section: Healthcare
ISI Impact Factor (2021-22): 2.176
IC Value (2020): 91.47
SJIF (2020) = 7.893

The Art of Seeing the Invisible: CBCT & Missed Canals

Munish Singla[1], Harleen Kaur[2], Litik Mittal[3], Savrose Kaur[4*]

[1]MDS, Head of the Department, Department of Conservative Dentistry and Endodontics, Adesh University, Bathinda, Punjab; [2]MDS, Professor, Department of Conservative Dentistry and Endodontics, Adesh University, Bathinda, Punjab; [3]MDS, Professor, Department of Conservative Dentistry and Endodontics, Adesh University, Bathinda, Punjab; [4]Persuing MDS, Postgraduation Student, Department of Conservative Dentistry and Endodontics, Adesh University, Bathinda, Punjab.

ABSTRACT

Radiographic imaging is a primary and most essential step in the diagnosis, treatment planning and assessing the treatment outcomes of all the cases in endodontics. There are several confounding factors like regional anatomy and superimposition of the teeth and adjacent dentoalveolar structures that influence the interpretation of an image. Due to the complex maxillofacial skeleton, conventional two dimensional (2-D) radiographic images fail to provide accurate information. The structures so visualized are also subject to geometric distortion. Since untreated anatomy has been documented as a significant cause of endodontic failure. Hence, recent research has highlighted the need for 3-D imaging modality to be used as an adjunct to overcome the potential drawbacks of 2D radiography in assessing the root canal anatomy.

Key Words: CBCT, 2-Dimensional, 3-Dimensional, Diagnosis, Missed canal, Radiography

INTRODUCTION

Thorough knowledge of root and root canal morphology is required for effective nonsurgical and surgical endodontic treatments.[1] The identification of root canal anatomy for a particular patient can still present a challenge clinically because of extensive variation of root canal morphology between patients. Improper identification of all relevant anatomic features can lead to predictable failure of treatment. Untreated anatomy has been documented as a significant cause of endodontic failure.[1,2]

Managing the endodontic problems successfully requires the diagnostic imaging techniques which is an adjunct to treatment planning, disease monitoring and assessment of treatment outcome.[3]

In 1899Kells brought a new era to dentistry and more specifically endodontics, by stating the possibility of detecting a lead wire placed in the root canal on a "radiogram" that would enable establishing the length of a root canal. Since then, conventional radiography has been a most trusted fundamental tool in endodontic practice.[4]

Conventional radiography has remained the foundation of imaging in endodontics. Two-dimensional periapical films have been the standard diagnostic imaging modality used for determining both root structure and extent of any apical periodontitis present. Limitations of conventional periapical radiograph can lead to misdiagnosis.[5] These constraints paved way for different advanced techniques of cross-sectional imaging which metamorphosed the concept of diagnosis and treatment planning in dentistry.

CBCT is not to be considered as a replacement for the conventional imaging systems rather it is a complimentary imaging tool for specific applications. It is more reliable and non-invasive method to view the root canal anatomy.

PROBABILITY OF MISSED CANAL IN DIFFERENT TEETH

According to literature overall prevalence of missed canals among endodontically treated teeth was 12 – 42%. The prevalence in the maxilla was higher than in the mandible. The prevalence of missed canals was higher in maxillary first molars with 40.6% followed by maxillary first premolars with13.6%, while the lowest prevalence was found in maxillary second premolars with 4.3%. All missed canals in the mandible were found in the first molars with a prevalence of 25%.

Corresponding Author:
Dr. Savrose Kaur, Persuing MDS, Postgraduation Student, #1477, Urban estate Phase - 3, Bathinda, Punjab; Mobile: 9478187371;
Email: kaurshabsidhu09@gmail.com

ISSN: 2231-2196 (Print) **ISSN:** 0975-5241 (Online)

Received: 21.02.2022 **Revised:** 19.03.2022 **Accepted:** 17.04.2022 **Published:** 20.05.2022

Another study by Karabucak et al. reported an overall incidence of missed canals was 23.04%;the incidence of missed canals was highest in themaxillary molars (40.1%) and lowest in the maxillary premolars (9.5%). The second mesiobuccal canal in maxillary first molars (65%), the second distal canal in mandibular first molars (62%), a mesial canal in mandibular second molars(78%).(Table – 1)

2D versus 3D

Intraoral periapical radiograph during endodontic procedure is still the most commonly used treatment adjunct. They provide useful information about the location of periradicular lesions, root canal anatomy and proximity of adjacent anatomical structures.[6]

Compression of three-dimensional anatomy

By compressing the three-dimensional anatomy into a two-dimensional image, conventional radiography adversely limits the diagnostic accuracy. The appreciation of the buccolingual plane is minimal and the spatial relationship of the roots to the neighboring anatomical structures is unclear thereby compromising radiographic interpretation.

This missing third-dimension capability is crucial for presurgical assessment. To find the missing piece of information, parallax radiography is suggested. However, even after multiple exposures, some areas can go undetected.[7]

Anatomical distortion

Image distortion and superimposition of various anatomical structures results in obstructing the area of interest compromising visualization further limiting the diagnostic information.

APPLICATION OF CBCT

CBCT is used to assess teeth with unusual morphology such as Vertucci's classification, "C" shaped canals, dens in dente, fused teeth, teeth with unusual number of roots and other developmental anomalies.

They are also useful during intra-operative procedures such as detecting missed canals during retreatment, broken instruments, perforations and calcified canals. CBCT imaging also allows for better visualization of the perforation site in various sections and angulations without any geometric distortion of images.[8]

CBCT was useful in detecting the asymptomatic non-healed lesions during the post-treatment follow up period to identify the cases requiring retreatment.[9]

DIAGNOSING THE MISSED CANAL BY 3D – CBCT

CBCT was embraced into the dental settings very rapidly due to its compact size, low cost, low ionizing radiation exposure when compared to medical computed tomography.[10]

Alike medical CT, 3-dimensional evaluation of the maxillofacial region with minimal distortion is offered by the CBCT. Few cases which were diagnosed via CBCT are stated below:-

1. Patient reposted to dentist with chief complaint of pain in root canal treated maxillary molar. Even after taking multiple radiographs at different angulation no such reason was found that was leading to pain. Finally, CBCT was advised to evaluate the hidden truth for better diagnosis.[11](Figure – 1)
2. Another case of mandibular molar where patient gave a history of pain after 6 months of root canal treatment.[11](Figure – 2)
3. A case with a symptomatic tooth after root canal treatment was reported. On radiographic examination two canals have been filled to a good length. As the symptoms were persisting a CBCT evaluation was done which revealed missed ML canal.[12](Figure – 3)
4. In this particular case, after the RCT symptoms returned only 2 canals were found. After extensive searching under the microscope, a possibility of one of those tricky 2 rooted Maxillary molars was predicted. Since symptoms returned, a CBCT evaluation was done. The palatal and DB roots were fused as one. Sagittal view shows the missed DB canal. Axial view shows the missed DB as well. The CBCT is now a map for retreatment.[13]

DISCUSSION

CBCT scan is used to diagnose missed canals in RCT teeth. CBCT has many benefits that provides 3D images allowing the analysis of multiple slices per tooth, and it is less susceptible to errors in identifying RCS than conventional and digital periapical radiographs. Liang et al. used CBCT and conventional radiography to compare the quality of root canal treatment. CBCT revealed a higher number of endodontic failures as compared to conventional radiography.

Even some recent scientific reports have discussed about the increasing professional concerns over the potential association between radiation exposure and cancer while using the CBCT scan. Although CBCT has a lot of advantages over the conventional radiography in the field of diagnosis but still the cost factor remains a persistent issue in establishing such a diagnostic equipment in daily routine.

Hence due to more radiation and exposure time it can only be used as an adjunct to routine radiography rather than a must tool.

CONCLUSION

Probably the most significant disadvantage of CBCT is that it produces a worse contrast resolution compared to fan-beam CT, making it harder to view soft tissue. The contrast resolution of CBCT is limited by high scatter radiation during image acquisition.

Artifacts are another disadvantage during CBCT scan, even though streaking and motion artifacts are mostly limited while using CBCT, but they are not entirely avoided. Several causes could lead to artifacts, such as minor patient movement during scanning and cone beam defects.[6]

In clinical endodontics, the application of CBCT should be based on a benefit-risk analysis. Since CBCT utilizes ionizing radiation, patient exposure should be kept as low as reasonably achievable (ALARA) to avoid unnecessary radiation hazards. Hence CBCT should be used as an adjunct to periapical radiography rather than a itself being a primary diagnostic tool.[8,9]

ACKNOWLEDGEMENT

I take this moment to thank personally each and every one who had helped me during the various stages of this work. Primarily I would like to thank almighty who always held in reserve blessings for me and gave me strength and directions all year of my life.

My heartfelt thanks and gratitude to **Dr. Munish Singla**, Professor and Head, Dr **Harleen Kaur** (Professor), **Dr Litik Mittal** (Professor), Department of Conservative Dentistry & Endodontics, Adesh Institute of Dental Sciences & Research for his constant guidance and motivation.

I would also like to thank our Librarians for giving us access to all the recent e-journals and helping us in collecting all the data.

I am deeply indebted to my beloved parents, my brother who have forever stood by me in my times of despair and no amount of words will suffice the gratitude that I have towards them for their love and never ending support.

Source of funding: None

Conflict of Interest:

The author declares that they have no conflict offunction.

Authors Contribution

	Dr. Munish Singla	Dr. Harleen Kaur	Dr Litik Mittal	Dr Savrose Kaur
Concepts	✔	✔	✔	
Design		✔		✔
Intellectual content	✔	✔		✔
Literature search			✔	✔
Manuscript editing		✔	✔	✔
Manuscript review	✔	✔	✔	

REFERENCES

1. Ahmed HMA, Versiani MA, De-Deus G, Dummer PMH. A new system for classifying root and root canal morphology. Int Endod J 2017;50(8):761-70.
2. Lee G, Lankalis J, Tamari K, Singer SR. Use of cone-beam computed tomography in diagnosing and treating endodontic treatment failure: A case study.J Orofac Sci2017;9(1):58-62.
3. Chandra A. Discuss the factors that affect the outcome of endodontic treatment.Aust Dent J2009; 35(2): 98-107.
4. Kiarudi AH, Eghbal MJ, Safi Y, Aghdasi MM, Fazlyab M. The applications of cone-beam computed tomography in endodontics: a review of literature. Iran Endod J2015;10(1):16-25.
5. Kapshe N, Pujar M, Jaiswal S. Cone beam computed tomography: A review. Int J Oral Health Dent 2020; 6(2):71-77.
6. Ramesh S, Sankar A. 2D Vs 3D Imaging In Endodontics-A Review. Ann Rom Soc Cell Biol 2021;25(6):1541-9.
7. Matherne RP, Angelopoulos C, Kulilid JC, Tira D. Use of cone-beam computed tomography to identify root canal systems *in vitro*. J Endod 2008; 34(1): 87–9.
8. Fathima S, Manikandan D. CBCT In Dentistry-An Overview. Eur JMol2020; 7(5): 1403.
9. Sethi P, Tiwari R, Das M, Singh M.P, Agarwal M, Ravikumar A.J. Two dimensional versus three-dimensional imaging in endodontics--an updated review. J Evol Med Dent Sci 2016; 5(84): 6287-93.
10. Venkatesh E, Elluru SV. Cone beam computed tomography: basics and applications in dentistry. J Istanb Univ Fac Dent2017;51(1):S102-S121.
11. Estrela C, Bueno MR, Sousa-Neto MD, Pécora JD. Method for determination of root curvature radius using cone-beam computed tomography images.Braz DentJ2008; 19(2):114-18.
12. Mashyakhy M, Hadi FA, Alhazmi HA, Alfaifi RA, Alabsi FS, Bajawi H, et al. Prevalence of Missed Canals and Their Association with Apical Periodontitis in Posterior Endodontically Treated Teeth: A CBCT Study. Int J Dent 2021; 2021: 9962429.
13. Hales JJ, Tonioli MB. Finding Missed Canals Using Cone Beam Computed Tomography (CBCT). The Endo Blog.2012.

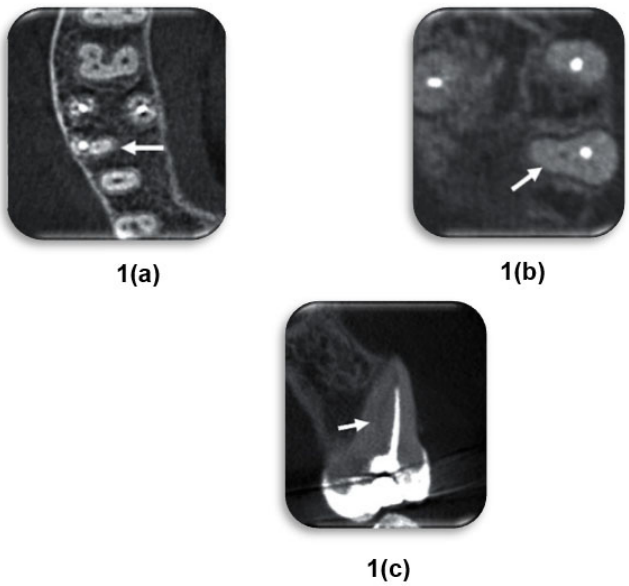

Figure 1: [11]a,b. CBCT slices of the maxillary first molar axial section with the missed MB2 canal (arrows)
c. Coronal section with the missed MB2 canal (arrow)

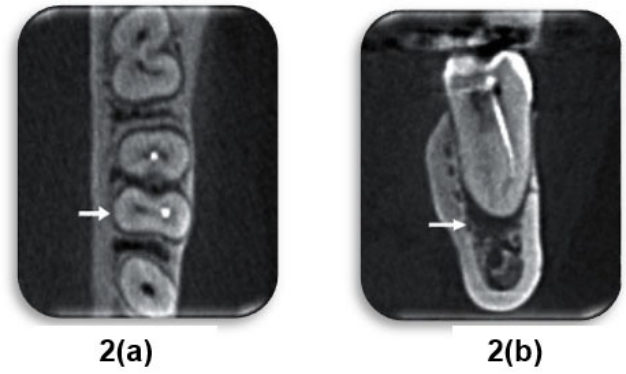

Figure 2: [11]CBCT slices of the mandibular first molar.
Axial section with the missed ML canal (arrow)
Coronal section with the missed ML canal and the presence of apical radiolucency (arrow)

Figure 3: [12]IOPA of root canal treated mandibular molar.
Slice of mesial roots showing the buccal filling and the ML missed canal
The sagittal view tells us where to look when we retreat this tooth.