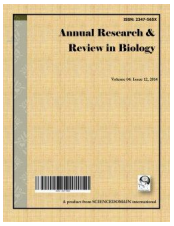

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Applications of CBCT in Surgical Endodontics- A Case Series

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Authors' contributions

This work was carried out in collaboration between all authors. Author AA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors AC, APT and PV managed the analyses of the study. Author RB managed the literature searches. All authors read and approved the final manuscript.

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Case Report

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ABSTRACT

The success of surgical endodontics depends on accurate diagnosis and treatment planning. Radiographic examination continues to be an essential part of diagnosis and management. Conventional periapical radiography creates superimposition and distortion. Low magnification provides inadequate diagnostic information and leads to compromised treatment. Cone Beam Computed Tomography (CBCT) overcomes the limitations by generating a 3-D image. In addition, CBCT provides a small field of view at low doses with sufficient spatial resolution and gives fine details of the surgical site. The present paper describes successful management of specific cases and how diagnosis and treatment planning has improved with the use of CBCT technology when compared to conventional radiography. In case 1 palatogingival groove was viewed through the axial and sagittal section of CBCT which was not seen in conventional radiograph. In case 2 non odontogenic cyst was evaluated through CBCT which showed that the pathology was not confined with the maxillary central incisor and in case 3 impacted root was detected in CBCT image.

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Keywords: CBCT; conventional radiography; surgical endodontics; diagnosis; treatment.

1. INTRODUCTION

Over the last 30 years, revolution in diagnostic radiology is due to the development of new technologies in the field of dentistry. Cone Beam Computed tomography (CBCT) is one such advanced diagnostic tool. CBCT provides 3D images for visualizing an individual tooth or the dentition in relation to the oral-maxillo facial skeleton [1]. This imaging technique is increasingly used as diagnostic tool in endodontic practice. CBCT technology in the field of dentistry having two main key factor the first being improved, rapid, and cost effective computer technology and second to provide multiple dental imaging which help in broad diagnostic information and treatment planning [2]. The European Society of Endodontology stated that 3D images provide additional information for the diagnosis and enhanced treatment planning of endodontic problems [3]. Comparative studies have shown CBCT to be more accurate than conventional radiography in the diagnosis of resorptive lesions, periapical bone defects, dystrophic calcifications, developmental anomaly, crown root fractures and foreign object in the periapical region [4]. The purpose of this case series is to illustrate the applications and to provide a better understanding regarding the use of this 3D imaging system, in the management of surgical endodontics.

2. CLINICAL APPLICATIONS OF CONE BEAM COMPUTED TOMOGRAPHY IN ENDODONTICS

2.1 Case 1 - Detection of Palatogingival Groove

A 29-year- old female patient with the chief complaint of intermittent pus discharge since 6 months from the palatal side in relation to tooth number 12 reported to the Department of Conservative Dentistry and Endodontics, King George's Medical University, Lucknow. On clinical examination, palatal alveolar mucosa in relation to tooth 12 exhibited a draining sinus tract. It was associated with a 12 mm probing defect. The pulp did not respond to sensitivity tests. An intraoral periapical radiograph revealed periradicular radiolucency extending up to the root apex. The case was diagnosed as perio-endo lesion considering the apical extent and groove seen in CBCT (Planmeca, ProMax). Treatment strategy planned was conventional root canal treatment, sealing of groove with MTA, and deep curettage of the periodontal pocket. The patient was explained the aberrant morphology associated with the tooth number 12, its treatment plan and outcome and written informed consent was obtained. Under local anesthesia (2% lidocaine with 1:1,00,000 epinephrine, LOX 2% Neon Lab, India), single visit root canal treatment was completed by lateral condensation technique with the use of Gutta percha cones and epoxy-resin based root canal sealer (AH plus sealer, Dentsply Maillefer, Tulsa, OK, USA). The tooth was restored using composite resin and the patient was recalled after 3 days for surgical procedure. Under greater palatine nerve block, intrasulcular horizontal envelope incision was given and palatal mucosa was reflected using the periosteal elevator. The palatogingival groove was roughened using ultrasonic tips and was immediately restored with MTA (Pro Root; Dentsply, Tulsa Dental, Johnson City, TN). The flap was repositioned and securely sutured with a 5x0 monofilament suture. [Fig. 1]

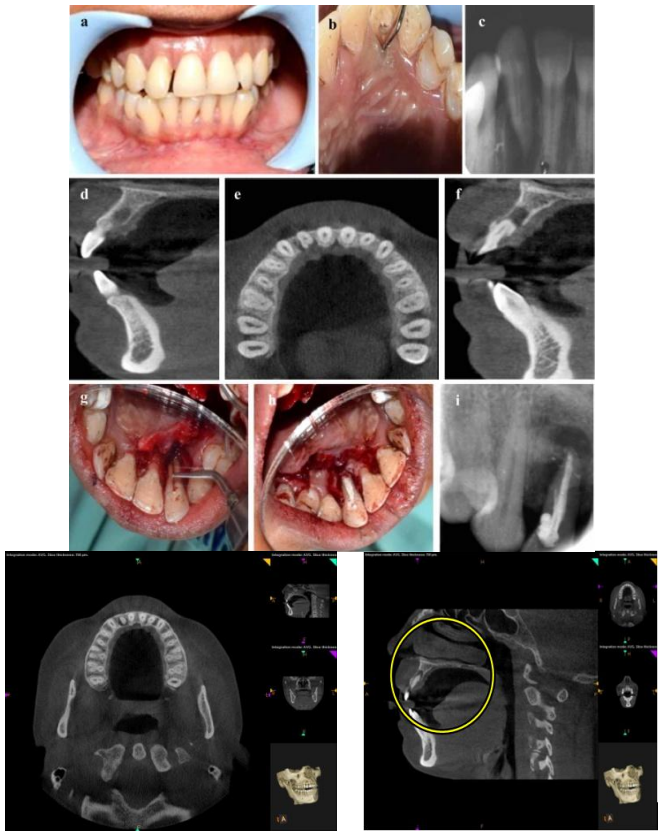
2.2 Case 2 –Detection of Non Odonto-genic Cyst

A 20-year-old female patient with the chief complaint of intermittent pus discharge from the palatal aspect in the upper tooth region for past 6 months reported to the Department of Conservative Dentistry and Endodontics, King George's Medical University, Lucknow. On clinical examination, a palatal swelling was seen. IOPA and occlusal radiograph showed periapical radiolucency in relation to 11 and 21. The vitality test was positive in relation to the tooth number 11 and 21. CBCT (Planmeca ProMax) was done to confirm the diagnosis. Cross-section and axial images showed that the lesion was not related to 11 and 21. Removal of the cyst was planned by palatal approach and the vitality of the relative teeth were preserved. The treatment plan and outcome was explained to the patient following which a written informed consent was obtained. Under local anesthesia (2% lidocaine with 1:1,00,000 epinephrine, LOX 2% Neon Lab, India), with greater palatine nerve block, intrasulcular horizontal envelope incision was given and palatal mucosa was reflected using a periosteal elevator and the cyst was carefully removed. As the cavity size was large, PRF was prepared using 5 ml of patient's blood by

centrifuging at 3000 rpm for 10 minutes. Sling suture was given after placing PRF and stabilizing the flap [Fig. 2].

2.3 CASE -3 Detection of Impacted Root in Relation to Maxillary Left Central Incisor

A 24-year-old male with the chief complaint of intermittent pus discharge from the upper front tooth region for the past 6 months reported to the Department of Conservative Dentistry and Endodontics, King George's Medical University, Lucknow. A clinical image of the right maxillary central and left incisor subjected to endodontic surgery with sinus formation in relation with tooth 11 was seen. The Periapical radiograph showed an apical lesion with respect to teeth 11 and 21. A CBCT (Planmeca, ProMax) was performed before endodontic surgery. The treatment plan and outcome was explained to the patient. Sagittal and axial images confirmed a circumscribed apical lesion and extra root in relation to 21 and apical lesion was seen affecting the buccal plate. Single visit root canal treatment was completed by lateral condensation technique with the use of Gutta percha cones and epoxy- resin based root canal sealer (AH plus sealer, Dentsply Maillefer, Tulsa, OK, USA). The tooth was restored using composite resin and patient was recalled on the following day for the surgical procedure. Under local anesthesia (2% lidocaine with 1:1,00,000 epinephrine, LOX 2% Neon Lab, India) vertical incision, intrasulcular horizontal envelope incision was given and flap was reflected using periosteal elevator. An extra root was detected with respect to tooth no 21, which was carefully extracted with an elevator. MTA (White ProRoot MTA, Dentsply Maillefer) was used as root-end filling material. The flap was repositioned and sutured with 5x0 monofilament suture.



Full image of CBCT showing Palatogingival groove

Fig. 1. (a) Preoperative image, (b) probing depth of pocket, (c) preoperative intraoral periapical, (d,e,f) sagittal and axial image of CBCT, (g) palatogingival groove, (h) groove sealed with MTA, (i) post obturation intraoral periapical x-ray

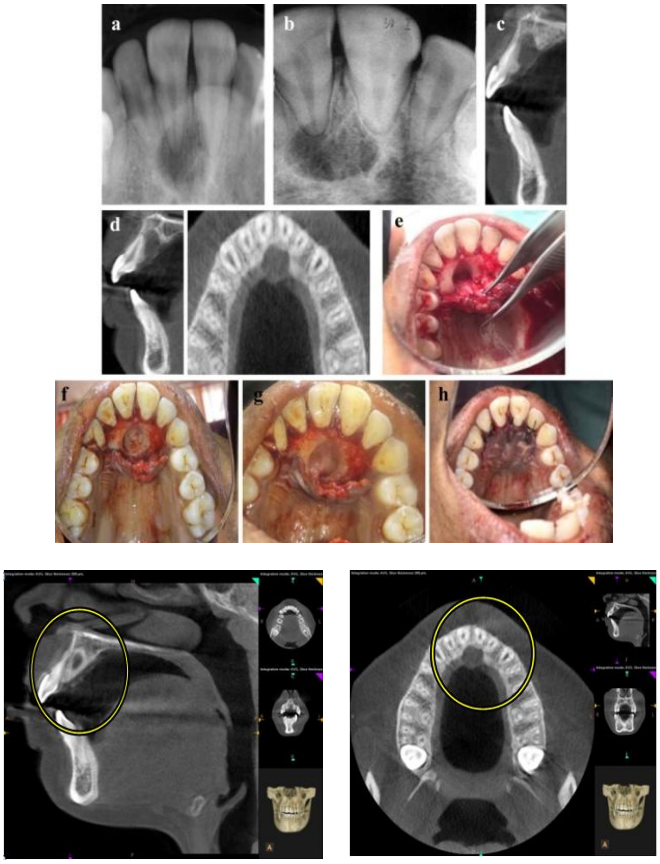


Fig. 2. (a) Preoperative intraoral periapical, (b) occlusal radiograph, (c,d,) sagittal and axial image of CBCT, (e) nasopalatine cyst (f,g) large cavity filled with PRF (h) post-operative image

3. DISCUSSION

In dentistry first application of CBCT was started in the United States in 2000 [5]. The joint statement of American Association of Endodontists (AAE) and the American Academy of Oral and Maxillofacial Radiology (AAOMR) issued in 2011 regarding the use of CBCT in endodontics and according to this statement, CBCT should be prescribed only after weighing the risks of radiation exposure with obtaining diagnostic information [6]. CBCT should never be routinely used, but only after a clinical examination to confirm the diagnosis and treatment outcome. CBCT technology helps in the diagnosis and treatment planning of detection of internal or external resorption, identification of odontogenic and non-odontogenic pathosis, alveolar fractures, assessment of canal morphology, and pre-surgical evaluation [7,8]. The Developmental anomaly in tooth depends upon the stages of tooth morphogenesis due to disturbance during the initiation or proliferation stage, which may cause anomalies in number of teeth, teeth size, shape, and structure [9]. The prevalence of palatogingival groove is 2.8–8.5%, hence a rare developmental anomaly [10,11]. CBCT scan was made to assess the extent and depth of lesion and to demonstrate the groove extended till the root apex in case I. Groove was managed using a surgical approach and sealed with calcium silicate based material MTA as it provides good biocompatibility and excellent marginal adaptation [12]. In Case II, conventional radiography showed periapical pathology but the relative teeth were vital. Sagittal and axial section of CBCT showed that pathology was not associated with teeth number 11 and 12 and biopsy report confirmed that pathology was a nasopalatine cyst. CBCT scans provide more clear image and extent of periapical lesions (34%) than conventional radiography [13]. Low et al. reported numerous clinical findings including expansion of lesions

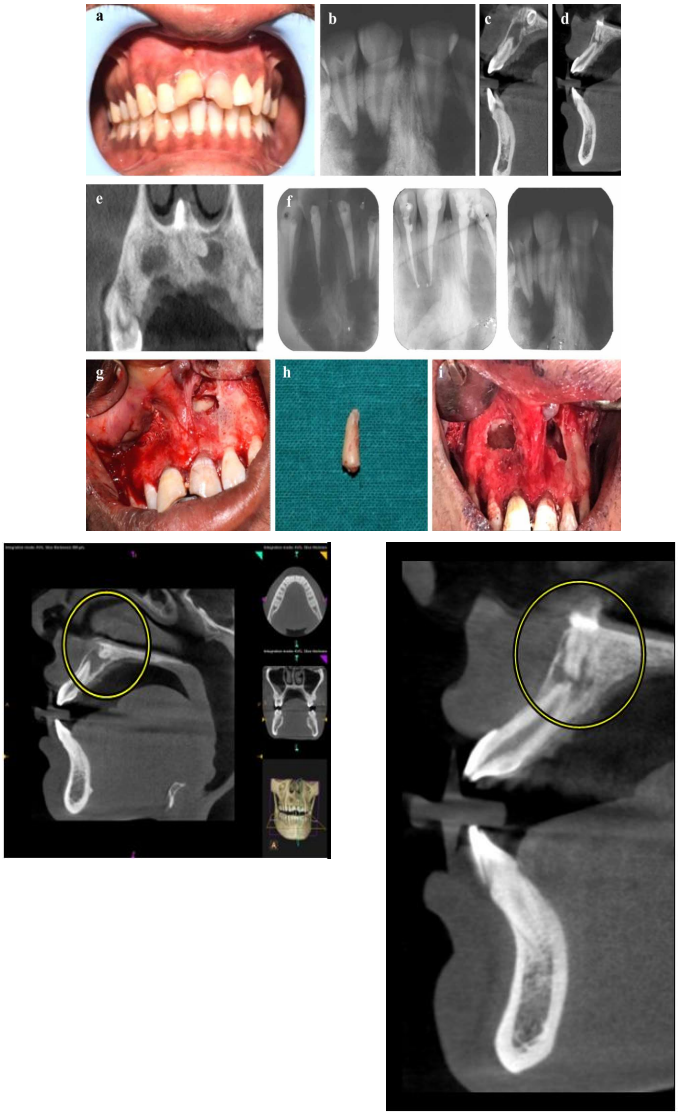


Fig. 3. (a) Preoperative image (b) preoprative intraoral periapical radiograph (c,d,e) sagittal and axial image of CBCT, (f) root canal treatment (g) impacted root in relation to 21 (h) extracted root (i) cavity for extraction of root

into the maxillary sinus, impacted teeth, foreign objects and missed canals were significantly seen with CBCT scan [14]. As in case III, CBCT showed an impacted root in relation to maxillary left central incisor which was not confirmed by conventional radiography. CBCT is a newer technology for specific applications and it provides accurate diagnosis. An increasing number of surgical endodontic cases are being identified as the use of technology becomes more widespread but it should not be considered as a replacement for standard digital radiographic applications [15].

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

4. CONCLUSION

Diagnosis is the key to successful treatment and diagnostic information directly influences clinical decisions. Now a days CBCT has become the first choice in endodontics, because of low ionizing radiation and higher resolution.

Knowledge about CBCT will help clinicians to make the full use of this excellent 3D imaging system.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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