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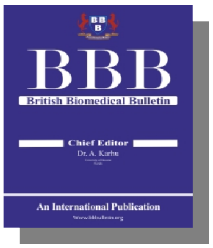

Original

An Update on the Use of Endodontics in CBCT

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ABSTRACT

The advent of CBCT has made it possible to visualize the dentition, the maxillofacial skeleton and the relationship of anatomic structures in 3D. CBCT represents a valuable resource in dental practice because it allows the establishment of a precise treatment plan by means of diagnostic imaging. In cases of increased difficulty or intra operative complications, root resorptions, perforations and root fracture it is prudent to consider the use of CBCT with its diagnostic value and limited radiation exposure. Analyzing the morphology of the root canals in human dentition conclude that the 3D image provided by CBCT is a great advancement as an auxiliary method to establish the endodontic diagnosis.

Introduction

The first cone-beam volumetric tomography unit was approved for dental use in the United States in 2000[1], numerous endodontic applications of this technology, along with cone-beam computed tomography (CBCT), has been described in the literature. Most of these applications are focused on preoperative assessment and treatment planning and include diagnosis, treatment of the pulp chamber of a compromised tooth, biomechanical instrumentation, and evaluation of final obturation and assessment of healing. Superimposition of teeth and surrounding dent alveolar structures in aperiapical radiographs remain the major drawback of two dimensional views, which can be overcome by utilizing small- or limited-volume cone beam-computed tomography imaging techniques, which produce accurate

3-D images of the teeth and surrounding dent alveolar structures.

Basic concept of CBCT

A cone shaped x-ray beam is used which orbits once around the patient obtaining information in a cylindrical volume. The patient's maxillofacial skeleton is positioned within the cylinder and is divided up into tiny cubes or voids. Computer manipulation (multiplanar reconstruction) of the data obtained allows separate images in the sagittal, coronal and axial planes.[2]The most important and clinically useful aspect of CBCT scanner is highly sophisticated software that allows the huge data collected to be broken down and processed or reconstructed into a format which closely resembles that produced by medical CT scanner. The smaller scan produces higher resolution images. In general, CBCT can be categorized into large, medium limited volume units based on this "Field of view" (F.O.V). The size of F.O.V describes the scan volume of CBCT machines.

For most endodontic applications[3], limited or small FOV CBCT is preferred for the following reasons:

1. Increased resolution to improve the diagnostic accuracy of endodontic-specific tasks such as the visualization of small features including calcified/accessory canals, missed canals, etc.
2. Decreased radiation exposure to the patient.

CBCT prescription

CBCT preferably should not be used routinely for endodontic diagnosis or for screening purposes in the absence of clinical signs and symptoms. The patient's history and clinical examination must justify the use of CBCT by demonstrating that the benefits to the patient outweigh the potential risks[4].

A significant issue that can affect the image quality and diagnostic accuracy of CBCT images is the scatter and beam hardening artifacts caused by high density adjacent structures, such as metal posts, restorations and root filling materials.

Applications of CBCT in management of endodontic problems

CBCT can be advised to detect the presence of previously undiagnosed periapical disease which can influence the decision making process when considering a non surgical/surgical approach to endodontic retreatment. The roots of maxillary posterior teeth and their periapical tissue can be visualized separately and in all three orthogonal plances without superimposition of the overlying zygomatic buttress, alveolar bone and adjacent roots[5].

Few complex situations that dictate the need for CBCT are[6-9]

- Taurodontism – to evaluate the complex root canal morphology and possible intra inter canal connections
- Identification of potential accessory canals in teeth with suspected complex morphology
- Determination of sound mesio-buccal canal in maxillary second molar. Stapled root canal patterns of mandibular molar teeth.
- Identification of the root canal anomalies and determination of root curvature
- Diagnosis and management of dental-alveolar trauma, especially root fracture, luxation injuries.
- Pre-surgical case planning to determine the exact location of root apex and proximity of adjacent anatomical structures such as inferior dental canal, mental foramen and maxillary sinus.
- A diagnosis of non–endodontic originpathosis in order to determine the extent of lesion

- Intra or postoperative assessment of endodontic treatment complications such as over extended root canal obturation material, separated endodontic instruments, calcified canal identification and localization of perforations.
- Localization and differentiation of external and internal root resorption or invasive cervical resorption from another condition and the determination of appropriate treatment and prognosis.

Intraoperative applications[10]

Intraoperative applications of CBCT include the following: location of calcified canals, evaluation of unexpected anatomic findings, and evaluation of missed canals inendodontic retreatment, evaluation of root resorption and root fractures, and assessment of iatrogenic errors such as perforation, fractured instruments, and extrudedobturation materials.

Conclusion

CBCT is a valuable tool in the Endodontists armamentarium. It is a useful tool for the diagnosis and management of endodontic problems, offering significant advantages of 3D imaging. It is a valuable task specific imaging modality producing minimal radiation exposure to the patient and providing maximal information to the clinician and adequate cost benefit effectiveness of the patient`s treatment.

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Figure 1. Granuloma

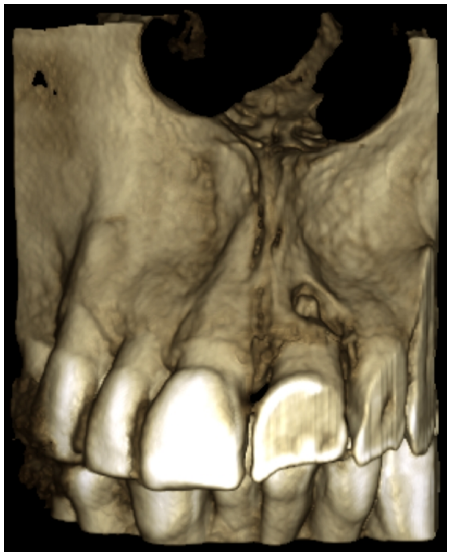

Figure 2. Abscess with root resorption

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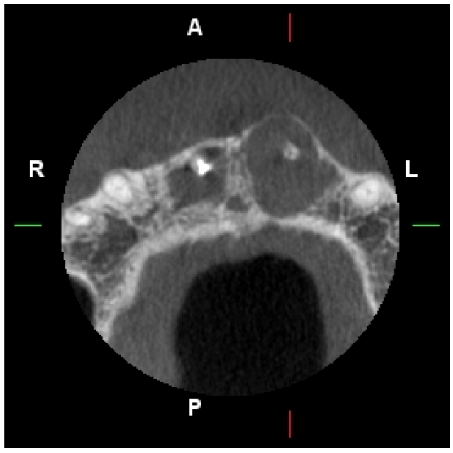

Figure 3. Radicular cyst