

How is Dentists Using CBCT in Their Clinics? - A Review Article

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Abstract

Review Article

Cone beam computed tomography (CBCT) was introduced in 1997. The aim of this article was to evaluate how CBCT are being used in dental clinics and identify different factors such as workflow of CBCT scan procedure and indications of CBCT. The most common indications for CBCT are implant treatment planning, planning for orthodontic mini-implants, evaluation of periodontal structures, airway, and temporomandibular joint. The enhancements in the digital software can be used for evaluation of CBCT such as contrast, brightness, zoom, etc. The interpretation of CBCT is performed by dentists, dental specialists, and oral radiologists. There are some challenges in CBCT such as artifacts and cost. However, the utility of CBCT may offset these disadvantages when indicated. This review articles describes how dentists use the CBCT in their clinical practice.

Keywords: Cone beam computed tomography, dental imaging, and image quality.

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INTRODUCTION

Dental Cone beam computed tomography (CBCT) has been introduced in dental radiographic since 1997 [1]. It has been widely used around the world in dental clinics since the past 10-15 years. 2D-imaging such as intraoral and panoramic radiographs, were the radiographic technique used previously for dental patients. Studies have shown that dental CBCT produces 3D recordings with a high level of accuracy for linear measurements of maxilla, mandible, and dentition [2-8]. Only a handful of studies have shown the impact on patient treatment planning by using CBCT as a imaging modality compared to 2D imaging [2, 9, 10]. There are different designs of CBCT machines available from the commercial companies with different hardware designs, field of view, voxel size, and other parameters that can change the image quality and radiation exposure [11-15].

CBCT is still relatively newer form of imaging compared to 2D-imaging and therefore it is vital to understand how CBCT is used and applied to get the best outcomes when recording a CBCT image. Therefore, the aim of this review article is to explain how dentist are using CBCT in the clinics.

Indications

In dental clinics, CBCT is commonly used for implant treatment-planning (34%). In dental specialist

clinics, CBCTs are commonly used for identifying impacted teeth. They are also used for identifying multiple root canals and accessory canals. The average number of CBCT per week range from 5 to 10 CBCT examinations in specialist clinics and fewer in dental clinics. When performing implant planning, panoramic imaging leads to using longer implants in posterior region, whereas CBCT helps in a more accurate estimation of the length of implant [9]. In specialty clinics, CBCT can be used for temporary mini-implant placement and that may help increase the success rates by avoiding any neighboring structures [16]. CBCT have been found to be advantageous for impacted teeth as they identify the location with adjacent teeth in all three planes. For identification of the relationship of mandibular third molars to mandibular canal, maxillary molars to maxillary sinus, palatal mini-implants to nasal floor, CBCT are used in dental clinics [17]. The measurement of airway volume with CBCT is performed for identifying the effects of treatment protocols such as expansion, protraction, etc [18, 19]. Additional, study has shown that treatment plans have been changed when comparing CBCT with 2D-images particularly in endodontics [9].

CBCT Scan procedure

In majority of clinics, dentist performs all CBCT scans. There are variations in the way the patient is positioned and head support devices used. Most

machine have a scout function for recording the CBCT and that allows you to identify whether the patient position is done properly before recording the CBCT [20]. If there are errors in the head position while recording the 2D-imaging, it can lead to errors in the final output [2]. However, CBCT does not have such limitations. Once the CBCT scan is recorded, it can be reconstructed using any of the several available CBCT software. The software enables the view and enhancement of CBCT with functions such as brightness, contrast, zoom, etc [21, 22]. This allows the proper visualization of structures. CBCT does lead to some artifacts [23, 24]. The most common artefacts reported with CBCT are metal tooth restorations that can lead to scattering. Similarly, titanium implants can also cause artifacts in CBCT. Another common artifact is the movement artifact in which the structures are seen as blurry and discontinuity in the border of bone or double tooth structures.

CBCT Interpretation and Use

The interpretation of CBCT is usually undertaken by the dentists and dental specialist when they record the images. The images are sent to the radiologist for their inputs and radiological report [25, 26]. Usually, the dentists and specialists interpret the CBCT before they receive the report. Even though usually, the structures represented in a CBCT are of sufficient quality so that the clinicians can identify the anatomical structures clearly, it is not always the case. In many CBCTs, the distortion due to artifacts such as motion and scatter, the CBCTs may not provide adequate information. The anatomical structures can be of inferior quality and the field of view may not be sufficient for some situations. CBCT used for assessing Temporomandibular Joint should include all components of both the right and left joint which is mandibular condyle, joint space, glenoid fossa, articular tubercle, etc [27]. The other factors that affect the CBCT interpretation is the experience of the evaluator and also the versatility of the CBCT software and the enhancements in the software.

A majority of dentists feel confident and satisfied with CBCT procedure. There is an improvement in the diagnosis, treatment planning and evaluation of prognosis, and fewer complications [28, 29]. This is true especially for some techniques such as osteoperforations that require very sound assessment of tooth structures so that the dental roots are not damaged during the procedure [30]. The positive experiences of CBCT are also related to the ease of use of CBCT. But on the other side, CBCT is also found to be more expensive and time-consuming. The cost factor comes in mainly due to the requirement of adding more personnel for the recording and reports of CBCT. 28-30 Impacted maxillary canines are a common condition for which CBCTs are recorded and can be useful in identification of location, root damage, dilacerations, etc [31]. For mandibular third molars it was observed

that the cost for CBCT may be higher than panoramic radiography for assessing the state of impactions [32]. However, these costs were found to be variable and differed between different dental and healthcare systems. The increased cost might be counterbalanced by the utility in many dental situations [33].

CONCLUSIONS

The current literature shows that CBCT is used by both dentists and dental specialists. Periodontists, oral and maxillofacial surgeons, and orthodontists are the most common dental specialists to use CBCTs. The most common uses for CBCT are implant treatment planning, location of impacted teeth, evaluating airway structures, analyzing treatment outcomes, etc. CBCT provide some challenges such as increased cost and artifacts due to metallic restorations, implants, and motion artifacts. However, the utility of CBCT may offset the increased costs where indicated.

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