

# CBCT in Implant Planning : A Review

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## Abstract

Cone Beam Computed Tomography (CBCT) has given a major contribution to the placement and planning of implants. CBCT offers more information on jaw bones and teeth with relatively low radiation doses and costs. Currently 85 different CBCT devices are available. Results of a CBCT data can be used to provide a surgical guide that transfers the implant planning information to the surgical site. CBCT has achieved a transition of dental imaging from 2D to 3D images. Clinical goals for implant planning and placement ,anatomical and prosthetic requirements for successful implant placement has been pointed out by some authors which are being presented with imaging resolutions, including CBCT scanning.

**Key words:** CBCT, implants, surgical guide

## INTRODUCTION

According to the World Health Organization, complete or partial absence of natural teeth is a public health problem with potential poor outcomes. Early in the evolution of Osseo integration surgery, clinicians placed implants in maximum bone volume which if not aligned properly can result in substandard outcomes including failure. Implant planning should include a crown to bone approach for finding the ideal location for supporting implant and investigating the bone to determine the feasibility of implant placement. Oral implants require localized area of oral and maxillofacial area for radiation exposure for which CBCT is an ideal choice. CBCT is being used for its lower dose of radiation, minimal metal artefacts, reduced costs, easier accessibility and easier handling. It enables us to measure the distance between the alveolar crest and mandibular canal to avoid impingement of inferior alveolar nerve, avoid perforation of the mandibular posterior lingual undercut and assess the density and quality of bone, and help in planning of oral implant in the maxilla with special attention to the nasopalatine canal and maxillary sinus.

CBCT uses a single 360 degree rotation around the maxillofacial region and a cone beam, in comparison, a spiral CT, which makes several rotations and uses a fan beam. The theoretical resolution of CBCT is higher than CT. The voxel size, an indicator of resolution can be small as 0.1mm for CBCT when compared 0.5mm for modern CT.

## INDICATION

For preoperative implants CBCT's are suggested because it provides cross sectional views that bring a clearer visualization of the anatomy of the surgical site. CBCT helps in demonstrating the possibility of lingual plate perforation by an implant. CBCT gives an information on the measurement between the accessory mental foramen and point of bifurcation from the mandibular canal and also gives information on the anatomic variations of the nasopalatine canals. CBCT scans helps in determining the quantity of bone available for craniofacial implants in the orbital rims

and in the immediate paranasal region. CBCT machines are used for diagnostic indications, yet also for presurgical planning and transfer to implant surgery and rehabilitation. CBCT allows the clinician to create and visualize the end result before initiating the treatment.

## CONTRA-INDICATION

CBCT cannot visualize non displaced fractures directly in roots or bone. Cannot diagnose caries adjacent to metal restorations. Metal artefacts prevent evaluation of Osseo integration. It can only demonstrate limited contrast resolution. CBCT should not be routinely used for detection of caries, periodontal bone loss, and periapical pathosis or for orthodontic diagnosis.

## Why to use CBCT in implant dentistry?

The first CBCT device was introduced in the late nineties with the initial scientific reports dating back from 1998. Accessibility of dental CBCT, due to its compact size, reasonable dose, low cost and ease of use is probably the prime contributor to its growing success. More than 85 distinct CBCT models are readily available, which include hybrid or so called multimodal system for combined 2D and 3D imaging apart from the less expensive and primary panoramic machines with a small detector size for scanning narrow field of view with a 3D button. The growing interest in CBCT use went hand in hand with the growing market for third party software for 3D surgical planning and guidance. Despite the dedicated properties of CBCT for dental maxillofacial examinations and its growing use over the last decade, more specifically in implant dentistry, one should realize that there is an enormous variation in radiation doses and image quality and attributed to machine and protocol dependent variables.

## What is the radiation dose level of dental CBCT?

Effective radiation doses for CBCT should be typically far below the levels of spiral CT, thus being considered as a true advantage. It should preferably be an equivalent of 2-10 pan-

oramic radiographs. Whereas in CBCT the radiation dose level differs from 2-200 panoramic radiograph. Only when respecting the strategy of time dependent monitoring of indication oriented and patient specific radiation doses, a dental practitioner may really comply to ALADIP (As Low As Diagnostically Acceptable being indication oriented and Patient specific), as position statement of Dimitra Research Group.

### **When to use CBCT in implant dentistry: existing guidelines?**

One recent systematic review on CBCT guidelines for use in implant dentistry presents an overview of all published guidelines including indications and limitations of CBCT used in implant dentistry.

### **How to use dental CBCT beyond radio diagnostic?**

Apart from its radio diagnostic potential, dental CBCT may present a further treatment procedure via CAD-CAM procedures. Nowadays studies are focusing on overcoming technological shortcomings by assessing optimization of exposure protocols or by registration of CBCT scans with optical data sets to eliminate the drawback of CBCT derived metal artefact. This helps to eliminate the necessity of the intraoral impression material and fabrication of dental cast. It is more comfortable to the patient compared to conventional impression taking and far more efficient for the daily work flow. It eliminates manual step and inevitable human errors when producing dental restorations.

### **CONCLUSION**

Reviews of recent publications reveals that CBCT is important in the diagnostic process and place an important role in treatment planning and outcome assessment. CBCT should be prescribed only when its benefits far out way the inherent risks. The use of CBCT imaging following insertion of dental implants should be restricted to specific post-operative complications, required implant retrieval and follow up of complex surgical procedures.

While to fully graph the per implant tissues, is to obtain a 3 dimensional view or the per implant tissues. And that brings us back to the clinical and potential means for 3 dimensional evaluation for long term maintenance and follow-up of dental implants, we are still forced to remain with per implant bidimensional bone level measures on correctly taken periapical radiograph, even if had no true prognostic value and considering that only the proverbial tip of the iceberg of actual size and morphology of defect seen.

### **REFERENCES**

1. Reinhilde Jacobs, Benjamin Salmon, Marina Codari, Bassam Hassan and Michael M. Bornstein. BMC Oral Health. 2018;18-88
2. Shawn Adibi, Wenjian Zhang, Tom Servos and Paula N. O'Neill. Journal of Dental Education .November 2012;76 (11) 1437-1442
3. Natl J. Maxillofac Surg. 2013 Jan-Jun; 4(1): 2-6.
4. Miracle AC, Mukherji SK. Cone beam CT of the head and neck. Part 2: clinical applications. Am J Neuroradiol 2009;30:1285-92.
5. De Vos W, Casselman J, Swennen GR. Cone-beam computerized tomography (CBCT) imaging of the oral and maxillofacial region: A systematic review of the literature. Int J Oral Maxillofac Surg. 2009;38:609-25.